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May 9, 1991

RECEIVED

MAY 1

Mr. S. Andrew Sochanski
DE/MD Remedial Section (3HW25)
U.S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, PA 19107

RE: Remedial Investigation/Feasibility Study
Work Plan Transmittal
Koppers Company, Inc. Newport Site
Newport, Delaware

Dear Mr. Sochanski:

On behalf of Beazer East, Inc. (Beazer) and E.I. du Pont de Nemours & Co., Inc. (Du Pont), enclosed for your review are four (4) copies of the Remedial Investigation/ Feasibility Study Work Plan for the Koppers Company, Inc. Newport Site in Newport, Delaware. Thank you for your time on this matter.

Sincerely,
DAMES & MOORE
A Professional Limited Partnership

Eric H. Tartler

Eric H. Tartler
Project Engineer

Attachment

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN
FORMER KOPPERS COMPANY, INC. SITE
NEWPORT, DELAWARE

Prepared for:
BEAZER EAST, INC.
436 SEVENTH AVENUE
PITTSBURGH, PENNSYLVANIA 15219

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDIX

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This document describes the Work Plan for the Remedial Investigation/Feasibility Study (RI/FS) to be performed at the former Koppers Co., Inc. (Koppers), Newport, Delaware site (Site). This Work Plan was prepared by Dames & Moore for Beazer East, Inc. (Beazer) and E.I. du Pont de Nemours and Co., Inc. (DuPont). From approximately 1929 until 1971, wood treating operations occurred at the Site. After 1971, title to the property was transferred to DuPont, who still holds title to the property.

On June 30, 1988, BNS Acquisitions, Inc. (BNS Acquisitions), a wholly owned subsidiary of Beazer PLC, acquired more than 90 percent of Koppers' outstanding common stock and acquired the balance of the remaining shares on November 14, 1988. On January 20, 1989, BNS Acquisitions merged with Koppers, and on January 26, 1989, Koppers Company, Inc. formally became Beazer Materials and Services, Inc. On April 16, 1990, Beazer Materials and Services, Inc. formally changed its name to Beazer East, Inc. This latter change is one of designation only.

This Work Plan will be the basis for performing an RI/FS at the former Koppers Company, Inc. Newport Site in Newport, Delaware. The goals of the RI/FS are to:

- Identify and characterize the nature and extent of the constituents of interest onsite and offsite resulting from past facility activities, environmental pathways, and potential receptors
- Assess the extent to which the detected constituents of interest pose a threat to the public health and welfare or the environment, and evaluate the extent of remediation, if any, required at the Site
- Produce appropriate and sufficient data to support the development and evaluation of remedial action alternatives
- Develop and evaluate remedial action alternatives, if necessary

Dames & Moore conducted a review of the available documents related to historical facility operations, previous Site investigations, and information on adjacent properties and the surrounding region. A Site visit was conducted by representatives of Dames & Moore in March 1991 to evaluate existing Site conditions. Information from this Site visit, along with the historical documents, was used to develop this RI/FS Work Plan.

Because of the limited nature of the document review and information gathering process, information and statements made herein are subject to modification or supplementation as more facts are learned. Further, because of the limited and preliminary nature of the factual investigation to date, statements made herein are not intended to be, and shall not be considered as, admissions of fact or law for any purpose, and shall not be admissible in any administrative proceeding for any purpose whatsoever.

This Work Plan presents the proposed technical approach for performing the RI field activities, including sample collection, monitoring well installation, groundwater sampling, and quality assurance review of analytical data, and details appropriate protocols and procedures for the performance of the RI field activities. The RI will be a phased program, where initial analytical results and information will be used to focus the subsequent field activities. Preparation of the FS will also be performed concurrent with the RI field activities, and additional data required to perform the FS will be identified and incorporated into the RI field activities.

1.2 RI/FS WORK PLAN APPROACH

In order to comply with the requirements of the Statement of Work tasks outlined in the Administrative Order on Consent for Remedial Investigation/Feasibility Study (Docket No. III-91-16-DC), this RI/FS Work Plan outlines the approach to be used for characterizing existing site conditions and evaluating remedial alternatives, if necessary. Each of the required task items has been incorporated into the Work Plan. The RI/FS Work Plan consists of the following elements:

- Summary of known Site conditions based on a review of historical information
- Identification of data gaps in the available historical information
- Initial definition of the potential areas of concern on the Site
- Definition of the scope and the objectives of the RI and the FS along with the methodologies to achieve those objectives
- Development of the data quality objectives to be achieved during the RI/FS
- Identification of the strategies to be used to evaluate the extent of sensitive ecological areas at the Site, and the potential impact, if any, of the Site on nearby receptors
- Initial tabulation and discussion of potentially applicable and relevant or appropriate requirements (ARARs) that may have to be considered during and after the RI/FS activities
- Preparation of a preliminary schedule for the completion of RI/FS activities

The data obtained during the RI will be used to characterize the potential areas of concern at the Site, assess the potential for impacts to public health and the environment, and identify actual or potential receptors. The information generated during the RI will also be used during the FS to develop and evaluate potential remedial alternatives, if necessary, that may be applicable to the constituents of interest present in the various media at the Site.

The remainder of this Work Plan is organized as follows:

- Section 2.0 presents a discussion of the Site location, history, and existing conditions.

- Section 3.0 identifies the potential areas of concern at the Site based on historical Site operations and previous investigation activities.

- Section 4.0 details the preliminary identification of ARARs.

- Section 5.0 provides the methodologies for identifying potential receptors and presents an outline of the ecological study.

- Section 6.0 defines the overall objectives of RI and the information to be generated during the course of investigation activities.

- Section 7.0 presents the phased approach that will be employed during the RI, outlines the components of the Site investigations, specifies the requirements of the proposed field sampling program (including quality assurance/quality control (QA/QC)), and details the analytical program to be used for the samples obtained during the RI.

- Section 8.0 addresses data management and reporting requirements.

- Section 9.0 details the FS approach.

- Section 10.0 provides preliminary schedules for the completion of RI/FS activities.

Other submittals required prior to the initiation of field activities, such as the Project Management Plan, Quality Assurance Project Plan, the Health and Safety Plan, and the appropriate analytical methodologies to be used will be incorporated into the Field Sampling Plan (FSP), which will become an integral part of this Work Plan.

2.0 SITE BACKGROUND AND CURRENT CONDITIONS

2.1 LOCATION AND HISTORY

2.1.1 Site Location

The former Koppers Company, Inc. wood treating facility was situated on a 317-acre parcel of land located in the northern part of New Castle County, Delaware, approximately 1/2-mile west-southwest of Newport and 5 miles southwest of Wilmington. The Site is reached via an access road that runs west from the Ciba-Geigy plant entrance at the intersection of James and Water Streets through the DuPont Holly Run Plant. The Site is located just south of the Amtrak railway and is bounded by Hershey Run, White Clay Creek, and the Christina River to the west, southwest, and southeast, respectively. A Site location map is provided as Figure 2-1.

2.1.2 History and Operations

2.1.2.1 Site History

The Site property was part of a group of land parcels owned by H. P. & B. B. Laynman and E. L. & J. F. Wright that were conveyed to the Delaware Wood Preserving Company in 1929. Wood treatment operations took place on portions of land currently referred to as the Koppers Site. The remainder of the property, a 20-foot wide strip of land approximately 2 acres in size, was conveyed to the Philadelphia, Baltimore and Washington Railroad. The railroad right-of-way is currently owned by Amtrak. No documentation has been found that indicates that wood preservation operations ever occurred on the 2-acre strip of land conveyed to the railroad.

In 1931, the wood treatment Site was sold to Century Wood Preserving Company (Century). The property and all associated stock were acquired from Century by the Wood Preserving Company in 1935. Through liquidation of the Wood Preserving Company, Koppers Company acquired the Site in 1940. In 1944, Koppers Company merged into the Koppers Company, Inc. Koppers continued to operate the wood preserving plant onsite until 1971 when the property was sold to DuPont. As part of the sales agreement, the chemicals in the process tanks onsite were removed by Koppers and structures onsite were removed by DuPont.

From 1974 to 1977, the New Castle County Department of Public Works (DPW) leased part of the Site and built and operated a wastewater treatment facility, but the scope and nature of operations at DPW's facility are presently unknown. In 1977 the County sold the building to DuPont. This building remains onsite, but reportedly the equipment from the wastewater treatment facility was removed.

On January 20, 1989, BNS Acquisitions, Inc., a Delaware corporation and a wholly owned subsidiary of Beazer PLC, merged with Koppers, and on January 26, 1989, the name Koppers Company Inc. was changed to Beazer Materials and Services, Inc. Beazer Materials and Services Inc. changed its name to Beazer East, Inc. on April 16, 1990.

2.1.2.2 Site Operations

Wood treatment operations began at the Site approximately 1929 and continued through 1971. Materials used in the wood preservation process included primarily a creosote coal/tar solution. However, pentachlorophenol (PCP) with No. 2 fuel oil reportedly was also used. These materials were used to preserve railroad ties and telephone poles among other wood products. Process wastes generated by the wood treatment included creosote solution and fuel oil containing PCP. These wastes were reportedly disposed of in surface impoundments and by incineration. Disposal practices for wastewater from the wood treatment process are unknown, although reportedly wastewater was collected in a holding pond located onsite.

2.1.3 Current Land Use

The Site is currently unused except for a small parcel (less than 1 acre) that is now part of the DuPont Holly Run facility. Existing facilities/structures and physical characteristics at the Site include: one warehouse building (constructed by the New Castle County Department of Public Works), several building foundations (former plant buildings and the facility manager residence), the Site access road, and a secondary road providing access to power lines. The railroad track spur lines shown on Figure 3-1 no longer exist; however, numerous railroad ties from these spur lines remain.

A pond is located on the Site west of the former process area. This pond is shown on the May 21, 1931 "Plan of Yard Showing Fire Lines" for the Delaware Wood Preserving facility as the source of water for the fire station pump house. A second small pond, identified as the Old Fire Pond in the NUS 1984 SI report, reportedly was located south of the tracks. A slight depression in the ground surface is all that remains of this pond. There is no record of either of these ponds being used for wastewater storage.

2.1.4 Adjacent Property Usage

The Site is bordered to the east by the DuPont Holly Run Plant, which manufactures chromium dioxide. The DuPont Newport Superfund Site, a site on the National Priority List (NPL), is located southeast of the DuPont Holly Run Plant (Figure 2-1) and southeast of the Site. Further east is the former DuPont pigment plant currently owned and operated by Ciba-Geigy Corporation.

Railroad tracks parallel the northern boundary of the Site. Although previously owned and operated by the Philadelphia, Baltimore and Washington Railroad, and subsequently by Conrail, Amtrak currently owns this right-of-way. Beyond the railroad tracks to the north are commercial and residential areas. The USGS 7.5 minute topographic map for Wilmington South, Delaware - New Jersey (1967, photorevised 1987) shows a sewage disposal area just north of the railroad tracks and opposite the northwestern portion of the Site. The operational history of this sewage disposal area is unknown.

Hershey Run, a tributary to White Clay Creek, borders the Site to the west. White Clay Creek and the Christina River border the Site to the southwest and southeast, respectively. Wetlands are associated with each of the three waterways that border the Site.

2.2 PREVIOUS INVESTIGATIONS

The Site has been the subject of previous investigations performed by representatives of the State of Delaware Department of Natural Resources (DNREC) and the United States Environmental Protection Agency (EPA) Region III. The results of these investigations are summarized below. Because Beazer and DuPont have not had full access to the results and supporting documentation of these investigations, Beazer and DuPont do not admit to nor concede the purported facts in the following summary, and reserve the right to modify or challenge same as more facts become known.

2.2.1 Site Investigation History

A Preliminary Assessment (PA) report of the facility detailing the known history and characteristics of the Site was prepared in 1984 by representatives of EPA and DNREC. In the PA report, EPA indicated that potential areas of concern were present and recommended that additional sampling activities be performed at specified locations. The recommendations of the PA report were incorporated into a sampling plan designed to further evaluate existing Site conditions.

A Site Inspection (SI) of the facility was performed in December 1984 by NUS Corporation, an EPA subcontractor, and a field sampling program was implemented at the Site. Onsite soil, sediment, surface water, and leachate samples were obtained during the field activities. Offsite surface water and sediment samples were also obtained from the Christina River, White Clay Creek, and Hershey Run. Samples were analyzed for Hazardous Substance List (HSL) metals, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). The results of this investigation are detailed under Section 3.0 of this document.

2.2.2 Results of Previous Investigations

Samples obtained during the SI revealed the presence of polynuclear aromatic hydrocarbons (PAHs) and metals in soil and sediment samples obtained from both onsite and offsite locations. Analytical results of the samples collected and analyzed during the SI are summarized in Tables 2-1 and 2-2.

ORIGINAL (Red)

The predominant organic constituents detected at the Site during the SI include the following base/neutral compounds:

- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Chrysene
- Fluoranthene
- Fluorene
- Phenanthrene
- Pyrene

Concentrations of these compounds were detected during the SI in the onsite soil samples taken near former process areas and in offsite sediment samples taken from adjacent Hershey Run. These compounds were not detected in any of the surface water samples analyzed.

Inorganic constituents (metals) detected in the samples obtained during the SI include:

- Aluminum
- Barium
- Lead
- Magnesium

Concentrations of these elements were detected during the SI in soil, sediment, and surface water samples obtained from onsite and offsite sources. Of the metals that were detected, only lead is in concentrations that are above background levels in soil and sediment. Aluminum and magnesium are common constituents of most soils, surface water, and groundwater. Barium is also considered to be a naturally occurring background element in these media throughout the area.

There is currently one groundwater well on the property--monitoring well MW-27A--associated with the adjacent DuPont Newport Superfund Site. Information concerning and obtained from this well, including well installation logs and groundwater monitoring results, will be used during the RI.

2.3 CLIMATE

New Castle County has a temperate climate and is characterized by well defined seasons with warm to hot summers and relatively mild winters. The mean annual temperature for the Wilmington area ranges from 44.4°F to 63.8°F (Soil Conservation

Service (SCS) 1970). Table 2-3 provides average monthly temperatures for Wilmington. Humidity is highest in late summer through early fall when the average relative humidity is about 75 to 80 percent (U.S. Weather Bureau and NOAA 1978).

In general, precipitation is distributed fairly evenly throughout the year, although precipitation is most variable in summer. The average annual precipitation for Wilmington is 45 inches, with monthly averages ranging from approximately 3 inches to slightly more than 4 inches, except for the month of August, when the area receives an average of 5.5 inches of precipitation (SCS 1970). Average monthly precipitation and 10-year extreme data are also provided on Table 2-3. The average annual snowfall in Wilmington is about 21 inches (SCS 1970).

Surface winds in Delaware are generally from the northwest. However, winds from the south to southwest prevail throughout the month of June and periodically from May through September (U.S. Weather Bureau and NOAA 1978). Wind speeds in northern Delaware are highest from January through April averaging 10 miles per hour (mph); from July through October average wind speeds range from about 7 to 9 mph (U.S. Weather Bureau and NOAA 1978). Brief violent windstorms with gusts up to 50 to 60 mph are not unusual in fall, winter, and spring.

2.4 GENERAL TOPOGRAPHY

The Site is located on the western edge of the Atlantic Coastal Plain physiographic province in northern Delaware. The Coastal Plain topography in New Castle County ranges from level to gently rolling hills. The county is drained by streams that flow into the Delaware River. The Site topography is fairly level, averaging 10 feet above mean sea level, and slopes gently to the south and west toward White Clay Creek, the Christina River, and Hershey Run (Figure 2-1). Portions of the Site are subject to regular tidal flooding. The present topography does not reflect the original undeveloped Site conditions. Fill material, including slag and sand, was apparently brought to the Site throughout the operational history of the facility to raise the prevailing grade of the land above the natural wetland elevation.

2.5 GENERAL GEOLOGY

The discussion of the general surface and subsurface geology that appears in this section is taken mainly from various Delaware Geological Survey publications. In addition, the geology and groundwater conditions have been studied extensively at the DuPont Newport facility immediately east of the Site. A 1987 hydrogeologic investigation of the DuPont Newport Superfund Site performed by Woodward-Clyde Consultants, Inc. (WCC) is also cited extensively in this section. Additional information has also been obtained from subsequent WCC reports on the DuPont Newport Superfund Site dated 1988 and 1991. Figure 2-1 shows the location of the adjacent DuPont Newport Superfund Site.

ORIGINAL
(Red)

The Atlantic Coastal Plain is separated from the Piedmont physiographic province at the Fall Zone, which is located 2 to 3 miles north of the Site. At the Fall Zone, Precambrian and Paleozoic igneous and metamorphic rocks of the Piedmont dip toward the southeast and become the basement rocks underlying a wedge of sedimentary deposits that forms the Coastal Plain. Coastal Plain sediments thicken and gently dip to the southeast. In Delaware the crystalline basement rocks are overlain by nonmarine Cretaceous sediments of the Potomac Formation.

During Late Cretaceous to Pleistocene times marine transgressive and regressive phases are known to have occurred from the sedimentary record in southern Delaware (Jordan 1962). However, none of these Late Cretaceous to Pleistocene sediments are present near the Site. Locally, nonmarine Pleistocene sediments of the Columbia Formation unconformably overlie Cretaceous sediments (Woodruff and Thompson 1972 and 1975). Holocene sediments occur along stream and river channels in the form of tidal marsh sediments and channel deposits (Woodruff and Thompson 1972 and 1975). Soils present onsite generally consist of tidal marsh sediments, silty to clayey loams, and fill (SCS 1970).

2.5.1 Soils

The soils of the Site are classified into three soil associations by the United States Department of Agriculture Soil Conservation Service (SCS 1970) (Figure 2-2). Note that these classifications are for natural soils, whereas a preliminary Site visit by Dames & Moore in March 1991 found that much of the natural soil at areas formerly occupied by facility operations at the Site has apparently been either removed or covered by fill. Approximately half of the soil onsite is classified as the Othello-Fallsington-Urban Land Complex, which is characterized by gray to brown silty loams and sandy loams that are generally poorly drained and variably covered by fill. This soil complex exists in most of the former operation areas.

The Tidal Marsh soil complex covers about one-third of the Site. This soil type varies from sands to clays and is sometimes mucky or peaty. This complex is regularly flooded by tidal waters and in some areas contains sulfur compounds.

The remaining portion of the Site is designated as Aldino-Keyport-Mattapex-Urban Land Complex. This soil complex is characterized by generally yellow-brown to dark brown silty loams and silty clay loams that are variably covered or replaced by fill. This soil profile is often cut away and subject to seasonal wetness.

2.5.2 Unconsolidated Sediments

The sedimentary deposits comprising the Coastal Plain in the vicinity of the Site are described in Section 2.5.2.1 (the Pleistocene Columbia Formation) and Section 2.5.2.2 (the Cretaceous Potomac Formation).

2.5.2.1 Columbia Formation

The Columbia Formation generally consists of yellow to dark reddish brown sand and gravel with lesser amounts of silt and clay beds (Jordan 1962). However, the formation color can be quite variable and can include tan, light gray, brown, or purplish-black sediments (Johnston 1973). Darker sediments tend to correlate with higher iron content; the purplish black color of ironstone beds may be due to manganese oxides (Spoljaric 1971).

In New Castle County, the Columbia Formation sediments were deposited by fluvial processes in channel fillings (up to approximately 130 feet) and in broad, sometimes discontinuous, sheets created by coalesced stream channels (Jordan 1964, Johnston 1973, Sundstrom and Picket 1971, Woodruff and Thompson 1975, and Woodruff 1986). North of the Chesapeake and Delaware Canal, Columbia paleochannels in New Castle County were apparently relatively straight and were separated by alluvial plains, flood plains, interchannel land areas, and islands (Spoljaric 1967a). Most of the significant present day streams in New Castle County (including the Christina River) exist in areas interpreted as former interchannel environments (Spoljaric 1967a). The thickness of the Columbia Formation varies widely due to variable erosion of the Columbia paleochannels into underlying sediments and the extent of subsequent erosion of the Columbia. In the Site vicinity the thickness of the Columbia sediments ranges from 0 to over 20 feet (Woodruff and Thompson 1972 and 1975). The Columbia Formation rests unconformably upon older units and is not formally subdivided lithostratigraphically in northern Delaware.

2.5.2.2 Potomac Formation

The Potomac Formation consists of white, gray, and rust-brown sands and gravelly sands interbedded with variegated white, yellow, red and grey, sometimes lignitic, silts and clays (Jordan 1962). Lithologies tend to be discontinuous in both the horizontal and vertical direction particularly as the geometry of the sands and silts is generally "shoestring-like" in aerial view (Spoljaric 1967b). In northern Delaware correlation of Potomac sand and silt bodies is difficult even over short distances (Jordan 1983). The Potomac Formation thins to the north-northwest as progressively older sections of the Potomac Formation subcrop beneath the Pleistocene and younger sediments (Woodruff 1985).

The Potomac Formation is Early to Early-Late Cretaceous in age (Jordan 1962 and 1983). Sediments are interpreted as nonmarine, predominantly fluvial. The paleo-environment of the Potomac Formation has been described as an alluvial plain/aggrading coastal plain that includes such depositional environments as flood plains, stream channels, lagoons, and estuaries (Jordan 1983).

In northern Delaware where the Potomac Formation is relatively thin the formation is not formally subdivided lithostratigraphically. However, in northern New Castle County, the Potomac Formation has been hydrologically subdivided into upper and lower hydrologic (sandy) zones that are separated by a layer of clay and silt (Sundstrom and Pickett 1967 and

1971). Studies by Jordan (1968) found a tendency for a greater proportion of sand to clay in the lower hydrologic zone of the Potomac than in the upper hydrologic zone. The upper hydrologic zone, defined as the first Potomac sand to occur below the Columbia Formation, is variably overlain by Potomac silts and clays. The upper sandy zone subcrops beneath, and is in direct contact with, the Columbia Formation south of the Christina River and is not present north of the river (Woodruff 1984b and 1985, WCC 1987).

Based on the Woodward-Clyde Consultants report on the DuPont Newport Superfund Site, the lower Potomac Formation apparently subcrops in the vicinity of the Site. However, at the DuPont Newport Superfund Site, a semiconfining unit 23 to 40 feet thick is present and separates the Columbia Formation from the more permeable aquifers of the lower hydrologic zone.

2.5.3 Bedrock

The Cretaceous through Quaternary sedimentary section was deposited unconformably on crystalline basement. Piedmont crystalline rocks, which outcrop at the surface about 3 miles to the north, dip toward the southeast to form the basement of the Coastal Plain. These Piedmont rocks are igneous and metamorphic rocks that are Precambrian and Lower Paleozoic in age. The crystalline Piedmont consists of marble schist of the Glenarm Series and gabbros, banded gneiss, granite, and amphibolite of the Wilmington Complex. In the Site vicinity, the depth to weathered bedrock is approximately 60 to 100 feet below mean sea level (msl) (Woodruff 1977 and 1981, WCC 1987 and 1988).

2.6 GROUNDWATER CONDITIONS

2.6.1 Regional Patterns

In the Coastal Plain of northern New Castle County, the water table aquifer consists principally of saturated sediments of the Columbia Formation. However, in some areas the water table also includes older subcropping sediments in direct hydraulic connection with the Columbia Formation. The Columbia Formation water table aquifer can be high yielding, particularly where there is more than 40 feet of saturated thickness.

The Columbia Formation is principally recharged from precipitation on the soil horizon at the land surface. Discharge from the water table aquifer includes yield to wells, base flow to streams, recharge to underlying aquifers, and evapotranspiration. Sundstrom and Pickett (1971) estimate base flow from the Columbia Formation to the Christina River to be approximately 628,000 gallons per day (gpd) per square mile, discharge to wells to be about 11 million gpd, and recharge to underlying artesian aquifers to be about 6 million gpd.

In northern New Castle County, the Potomac Formation is typically divided into two hydrologic zones separated by a clayey layer forming a leaking confining layer (Sundstrom and Pickett 1967 and 1971, Woodruff 1985). The top of the upper sandy unit begins from the first sand encountered beneath the Columbia Formation. The base of the upper sandy unit is defined by the top of a mappable clay in the middle third of the Potomac Formation (Woodruff 1984b and 1985). Except where the upper sandy unit subcrops, the upper sandy zone is generally overlain by Potomac silts and clays. Thin silts and clays are also found within the upper sandy zone and, to a lesser extent, in the lower sandy zone which correlates with the generally higher effective transmissivity found in the lower hydrologic zone as compared to the upper hydrologic zone (Sundstrom and Pickett 1971, Jordan 1968). Where they are present, both the upper and lower sandy zones of the Potomac Formation are important groundwater aquifers. Sundstrom and Pickett (1971) estimate the available water supply from the Potomac aquifers in New Castle County to be 33 to 38 million gpd, although actual yield of water from the Potomac varies with location.

Regional recharge to the Potomac aquifers occurs principally via vertical leakage from overlying sediments in areas where the vertical hydraulic gradients are downward. However, near the Site an area of groundwater discharge from the Potomac Formation to the water table aquifer (Columbia Formation) and then to the Christina River has been identified (Woodruff 1984a, WCC 1987).

2.6.2 Site Groundwater

Site-specific geologic or hydrologic studies have not been performed. However, local groundwater impacts have been documented on adjacent properties. As mentioned in Section 2.5, extensive hydrogeologic investigations have been performed over the period from 1987 through 1990 at the immediately adjacent DuPont Newport Superfund Site. Information from this investigation and from other studies can be used to evaluate Site conditions. There have been no known hydrogeological investigations on other adjacent properties to date.

The Columbia Formation is estimated to range from 0 to over 20 feet thick within Site boundaries (Woodruff and Thompson 1972 and 1975). Woodward-Clyde Consultants report a range in thickness of the Columbia Formation near the DuPont Newport Superfund Site to be from 25 to 34 feet (WCC 1987). The Koppers Site is in an area where the possibility for recharge to the Potomac Formation is classified as poor by the Delaware Geological Survey (Petty, et. al. 1983). Northeastern portions of the Site are considered probable recharge areas for the water table aquifer, while the rest of the Site (with surface elevations generally less than 10 feet above msl) are considered areas of probable groundwater discharge from the water table aquifer (Petty, et. al. 1983).

The water table is anticipated to be shallow, probably within 10 to 15 feet of the ground surface (Sundstrom and Picket 1971). The upper hydrologic zone of the Potomac Formation is not expected to be present under the Site because it is mapped as being completely eroded just south of the Christina River (Woodruff 1985). The absence of the upper sandy zone of the Potomac Formation north of the Christina River is supported by the Woodward-Clyde Consultants study of the DuPont Newport Superfund Site east of the

Koppers Site (WCC 1987). The water table aquifer beneath a portion of the Site may be underlain by the clayey semiconfining layer of the middle Potomac Formation identified at the DuPont Newport Superfund Site. However, the more permeable sandy zones of the lower hydrologic zone of the Potomac Formation may also subcrop directly beneath the water table aquifer in places.

Based on groundwater flow patterns developed by Woodward-Clyde Consultants near the DuPont Newport Superfund Site, groundwater in the water table aquifer in the eastern portion of the Site probably flows southward and discharges to the Christina River. Based on the surface topography, groundwater in the water table aquifer in the western portion of the Site may flow in a westerly or southwesterly direction and discharge into the adjacent wetlands or White Clay Creek. Groundwater within the upper portion of hydrologic zones of the Potomac Formation at the Site probably discharges into the Christina River. North of the Christina River in the vicinity of the DuPont Newport Superfund Site there are upward vertical gradients between the uppermost hydrologic zone of the Potomac Formation and the water table aquifer, as described in the Woodward-Clyde Consultants report (WCC 1987). Therefore, any degradation of groundwater quality in the water table aquifer is not expected to affect the underlying Potomac aquifer under natural conditions. The Woodward-Clyde Consultants report also indicates that groundwater flow in the lowermost hydrologic zone of the Potomac Formation in the vicinity of the DuPont Newport Superfund Site continues southward beneath the Christina River.

2.7 SURFACE WATER DRAINAGE

The Site topography slopes gently to the south and west toward the tidal marsh areas on the property and the Christina River, White Clay Creek, and Hershey Run. Hershey Run lies along the western boundary of the property and drains into White Clay Creek. White Clay Creek passes along the southwestern property boundary and discharges into the Christina River, which is adjacent to the southeastern edge of the property. These streams and the tidal marsh areas are each subject to tidal effects. The potential for drainage from the reported former sewage disposal area north of the Site onto the Site or into Hershey Run is unknown and will need to be evaluated in the RI.

2.8 WETLANDS/BIOLOGICAL RESOURCES

2.8.1 Pre-Development Site Conditions

The New Castle County Soil Survey indicates that the Site had either Othello-Fallsington-Urban Land Complex, Aldino-Keyport-Mattapex-Urban Land Complex, or Tidal Marsh soils prior to Site development, the addition of fill, and regrading. These original soils may all be described as poorly drained and all but the Aldino soil are listed as hydric soils by the New Castle County Soil Conservation Service and are an indication of historic wetlands throughout their occurrence.

Remaining Tidal Marsh soils are still clearly tidal wetlands. Freshwater nontidal wetlands do occur on the lower elevations of the Site. These wetlands may be characterized as upland scrub woodland and scrub/shrub palustrine wetlands (PFO and SS, respectively). Othello and Fallsington hydric soils are exposed at the surface in these areas.

The lower Site elevations grade into freshwater tidal marshes of Hershey Run, White Clay Creek, and the Christina River. Essentially all of the Site drains to and through these tidal and nontidal wetlands, although the pattern of surface drainage ways over the Site has mostly likely changed repeatedly over the course of the last 60 years or more.

2.8.2 Biological Resources

Biological resources of the Site are predominantly associated with wetlands and to a much lesser extent developed uplands. The uplands are predominantly grasslands on coarse fill with limited areas of scrub woodlands. Such open grasslands may provide habitat for small mammals and the raptors that feed on them. Large wildlife such as deer, rabbit, woodchuck, and fox may also use these habitats, especially those located along tributary corridors.

The least disturbed habitats on the Site are the tidal marshes and nontidal scrub and forested wetlands on the lower elevations. These wetlands provide better habitat for many of the upland wildlife species, as well as for many wetland-dependent species of plants and animals.

True aquatic habitats are limited on the Site with the exception of the tidal wetlands. Two small ponds occur on the Site and the eastern drainage ditch has a short section of nontidal stream. The tidal wetlands offer habitat for a wide variety of estuarine, riverine, and freshwater aquatic species.

The pertinent references for information on Site wetlands are: Simpson et. al. (1983); current ecological characterization reports from the Delaware Estuary Program, current Water Resources and Biological reports from the Water Supply Plan for New Castle County, Delaware, (Churchmans EIS 1990 and 1991); and current Wetland Restoration/ Enhancement Studies proposed for New Castle County by DNREC. These and other source documents will be reviewed to develop a comprehensive characterization of existing wetland/biological conditions as part of the Phase I investigation.

No mention has been made in the Site documents reviewed for this Work Plan regarding the occurrence of rare, threatened, or endangered species or species of special concern.

3.0 POTENTIAL AREAS OF CONCERN

3.1 INTRODUCTION

As discussed in the Section 1.0, this Work Plan and the statements contained herein are based on a review of available historic documentation relating to prior and current uses and/or operations at the Site and adjacent areas. Because of the limited nature of this review, and the preliminary nature of this work, information and statements made herein are subject to modification and/or supplementation as more facts are learned. Specifically, as more information is learned about this Site and its surrounding area, the potential areas of concern may be expanded or reduced.

Based on a review of the information obtained during the previous investigation activities and the historical operations of similar wood preserving facilities, the following potential areas of concern (PAOCs) have been identified, as shown on Figure 3-1. These areas are predominantly located within the formerly active production and storage sections of the facility, which were in a large part dismantled after the property was sold in 1971 to DuPont. The identified PAOCs include the following:

- Former Processing Operations areas (the Creosote Unloading area, Wood Treatment area and Drip Tracks). This area also contained the New Castle County Department of Public Works (DPW) wastewater treatment facility from 1974 to 1977

- Treated Wood Storage area

- Onsite Fire Pond and the South Ponds

- Wetlands (including woodlands) and the surface water bodies bordering the active areas of the former processing and storage areas

- Areas containing scattered process debris from historical facility operations

The former processing areas include the Creosote Unloading area, Wood Treatment area, and Drip Tracks, where active process operations and material handling were performed. The Treated Wood Storage area encompassed most of the remaining active section of the former facility. The Fire Pond, located in the northwestern section of the Site, reportedly was used as a source of water for fire-fighting purposes throughout the facility. The Old Fire Pond, as labelled in the 1984 SI report prepared by NUS for EPA and DNREC, reportedly is located in the southern section of the site. The location of the Old Fire Pond cannot be definitively determined at this time because of the overgrowth of the vegetation and the historical sediment deposition that have occurred since the closure of the facility in 1971. Currently there are two natural depressions in the vicinity of the reported location of the Old Fire Pond, both of which will be characterized during the RI. For the purposes of clarity, both of these depressions shall be referred to as the South Ponds for the remainder of this Work Plan, instead of the Old Fire Pond as originally referenced in the 1984 SI report.

The sections of the Site adjacent to the former operations areas consist primarily of wetlands and other potentially sensitive environmental areas. However, as shown on Figure 3-1, there are selected areas where scattered process debris and equipment, presumably used in the historical wood treating operations, are visible on the surface. The characteristics of these areas will be investigated and evaluated as part of the RI field activities to assess potential impacts.

Analytical results referenced under this section were obtained during preparation of the 1984 NUS SI report. During the SI, soil, sediment, and surface water samples were obtained at the locations shown on Figure 3-2 and analyzed for Hazardous Substance List (HSL) semivolatile compounds and metals. Neither the SI report nor the related field notes state whether the surface water samples obtained during this investigation were field-filtered prior to preservation. However, since only one surface water sample was obtained at each location, it is assumed that the analytical results reported are on a Total Metals basis. Summary listings of the 1984 SI analytical results are presented in Tables 2-1 and 2-2.

3.2 POTENTIAL AREA OF CONCERN 1 - CREOSOTE UNLOADING AREA, TREATMENT AREA, AND DRIP TRACKS

From a review of historic site documents, it appears that the Creosote Unloading area, Treatment area, and Drip Tracks were the primary areas for handling and treating wood at the facility. These areas were located in the northern section of the Site, as shown on Figure 3-3. Although each of these units was separate during the operational life of the facility, they will be considered collectively because of their close proximity. For the purposes of this Work Plan, these three operational units will be referred to as Potential Area of Concern 1 (PAOC 1).

This area was also used by New Castle County for the treatment of wastewater from 1974 until 1977. Material handling practices and facility operations will be further evaluated during the RI to determine the potential impacts on the Site from these operations.

3.2.1 History and Operations

3.2.1.1 Creosote Unloading Area

The Creosote Unloading area was used to discharge creosote and other wood preservatives into holding tanks prior to use. Historical aerial photographs indicate that there were four small tanks and one large tank adjacent to the treatment building that were used to handle both fresh and recycled preservative. The tanks were removed from service and demolished by Koppers during the 1970s after transfer of the property title to DuPont.

3.2.1.2 Treatment Area and Drip Tracks

The Treatment area, located along the northern boundary of the active facility, contained the treatment cylinders used in the preserving process. Untreated lumber was transported to the Treatment Building and introduced into the cylinders for processing. Creosote or other preservative were then injected into the lumber under high pressure. After treatment was complete, the lumber was removed from the treatment cylinders and transported to the Drip Tracks.

The Drip Tracks, located adjacent to the Treatment area, were typically used to temporarily store the treated lumber after processing. Pressure-treated wood removed from the treatment cylinders was moved to the Drip Tracks prior to transport to the Treated Wood Storage area. Visible staining in this area was noted on historical photographs of the facility.

The Drip Track area is located on an elevated section of the Site, adjacent to the northern property boundary. Staining is visible on the surface of this area, and along the perimeter of the southern sidewall. The area has a concrete base in sections.

3.2.2 Nature and Extent of Constituents of Interest

Soil samples obtained during the 1984 SI indicated the presence of PAHs throughout the former Treatment area and the Drip Tracks and revealed detectable levels of the following constituents:

• Benzo(a)anthracene	11,400 micrograms/kilogram (ug/kg)
• Benzo(a)pyrene	26,900 ug/kg
• Benzo(b)fluoranthene	36,000 ug/kg
• Chrysene	19,600 ug/kg
• Fluoranthene	28,100 ug/kg
• Aluminum	19,300 milligrams/kilogram (mg/kg)
• Barium	412 mg/kg
• Lead	30 mg/kg
• Magnesium	10,600 mg/kg

Surface water samples obtained from this area during the SI did not contain concentrations of PAHs but did contain the following levels of inorganic constituents:

• Aluminum	23,120 micrograms/liter (ug/L)
• Barium	103 ug/L
• Lead	17 ug/L
• Magnesium	47,300 ug/L

These results suggest that although the PAHs are present in the exposed soils in the former process area, they are not environmentally mobile as dissolved constituents in the surface water.

The metallic constituents detected in the surface water samples are not constituents of creosote. It should be noted, however, that aluminum and magnesium are common constituents of most soils, surface water, and groundwater, and therefore would be anticipated in the analytical results. Also, barium is typically present at naturally elevated concentrations in soil samples in the New Castle County Area, and therefore would also be anticipated to be detected in samples obtained at the site.

Additional samples are needed in this area to further define the vertical and horizontal extent of the constituents of interest.

3.3 POTENTIAL AREA OF CONCERN 2 - TREATED WOOD STORAGE AREA

3.3.1 History and Operations

The Treated Wood Storage area is located between the 10 sets of railroad tracks on the active facility and the eastern track. After removal from the Drip Tracks, treated lumber was transported to the Treated Wood Storage area, where it would be loaded for shipment offsite, as required. The railroad tracks were removed from these areas during the 1970s, although railroad ties are still in place at several locations throughout this area. For the purpose of this Work Plan, these areas will be referred to as Potential Area of Concern 2 (PAOC 2).

3.3.2 Nature and Extent of Constituents of Interest

Extensive sampling of this area was not performed during the SI. Surface samples obtained from within the Treated Wood Storage area at one location revealed the following levels of constituents:

- Benzo(a)anthracene 2,660 ug/kg
- Benzo(a)pyrene 6,750 ug/kg
- Benzo(b)fluoranthene 9,720 ug/kg
- Benzo(k)fluoranthene 8,780 ug/kg
- Chrysene 6,900 ug/kg
- Fluoranthene 6,300 ug/kg
- Aluminum 1,100 mg/kg
- Barium 336 mg/kg
- Lead 25 mg/kg
- Magnesium 27,400 mg/kg

Constituent concentrations in this area generally are lower than those detected in the former processing area. Additional samples are necessary in this area to further define the vertical and horizontal extent of the constituents of interest.

3.4 POTENTIAL AREA OF CONCERN 3 - FIRE POND AND SOUTH PONDS

3.4.1 History and Operations

The Fire Pond, located in the northwestern section of the former facility, reportedly was used to hold water for fire-fighting purposes, as shown on Figure 3-1. The Fire Pond, approximately 1 acre in size, is located adjacent to the Treatment area and is currently filled with water, although the exact depth is unknown at this time.

It is assumed that the Fire Pond was used to store water obtained from either an onsite pumping well or from the nearby surface water bodies. Existing Site plans indicate that water was drawn from this pond into the fire station pumphouse for distribution through pipelines throughout the facility to provide water in the event of a fire. Other uses for the water, if any, are unknown.

A second pond, labelled as the Old Fire Pond in the 1984 SI, was reportedly located downgradient of the former processing areas. Evidence of two natural depressions in this area was observed during the March 1991 Site visit. These natural depressions are now referred to as the South Ponds (see Figure 3-1). Sediment has filled in the majority of these ponds over time.

For the purpose of this Work Plan, the Fire Pond and South Pond areas will be combined into one unit and referred to as Potential Area of Concern 3 (PAOC 3).

3.4.2 Nature and Extent of Constituents of Interest

There are no data available on the quality of the sediments or the water within the Fire Pond. However, surface water and sediment samples were obtained from the downgradient South Pond (Old Fire Pond) during the 1984 SI performed by NUS. Samples were analyzed for the presence of the PAHs and HSL metals.

Sediment samples obtained from the South Pond (Old Fire Pond) indicated the presence of the following:

• Anthracene	25,200 ug/kg
• Benzo(a)anthracene	41,800 ug/kg
• Benzo(a)pyrene	63,100 ug/kg
• Benzo(b)fluoranthene	90,700 ug/kg
• Chrysene	54,900 ug/kg
• Fluoranthene	75,900 ug/kg

- Pyrene	76,300 ug/kg
- Aluminum	1,920 mg/kg
- Barium	199 mg/kg
- Lead	248 mg/kg
- Magnesium	1,690 mg/kg

The concentrations of the PAHs are similar in magnitude to those detected in the former process area. However, the concentration of lead detected in the sediments is approximately 10 times higher than those detected in the process area. Lead is not known to be a constituent of creosote and is typically not used in the treating process.

Surface water samples obtained from this area did not exhibit detectable levels of PAHs, although concentrations of metals were noted. The following metallic constituents were detected:

- Aluminum	728 ug/L
- Barium	163 ug/L
- Magnesium	29,600 ug/L

Lead was not detected in the surface water sample obtained from this area.

Additional soil and surface water samples are necessary in both the Fire Pond and the South Ponds to further define the vertical and horizontal extent of the constituents of interest.

3.5 POTENTIAL AREA OF CONCERN 4 - WETLANDS

3.5.1 Existing Site Conditions

The Site is surrounded on three sides by freshwater tidal wetlands (Figure 3-1). The majority of the Site may have once been freshwater, nontidal wetlands. Relic areas of these nontidal wetlands remain today. Previous Site investigations have indicated concentrations of PAHs and metals in sediments of the Hershey Run tidal marsh, the Fire Pond, and the eastern drainage ditch. Wetlands appear to be in the drainage course from upland Site areas to adjacent river or groundwater bodies.

3.5.2 Nature and Extent of Constituents of Interest

Sampling of the specific wetlands areas around the Site was not performed during the 1984 SI. Samples were obtained from a drainage ditch along the eastern perimeter of the Site, from Hershey Run along the western boundary of the property, and from White Clay Creek along the southern boundary of the Site. Both upstream and midstream surface water and sediment samples were obtained from Hershey Run and White Clay Creek during the 1984 field activities.

3.5.2.1 Hershey Run Sampling

Surface water and sediment samples were obtained from Hershey Run at both upstream and midstream sampling points, as shown on Figure 3-2. Upstream Hershey Run sediment samples indicated concentrations of the following constituents:

• Anthracene	1,870 ug/kg
• Benzo(a)anthracene	3,890 ug/kg
• Benzo(a)pyrene	10,600 ug/kg
• Benzo(b)fluoranthene	8,480 ug/kg
• Benzo(k)fluoranthene	6,060 ug/kg
• Chrysene	6,260 ug/kg
• Fluoranthene	1,870 ug/kg
• Phenanthrene	1,080 ug/kg
• Pyrene	1,380 ug/kg
• Aluminum	20,000 mg/kg
• Barium	896 mg/kg
• Lead	462 mg/kg
• Magnesium	5,380 mg/kg

PAHs were not detected in the surface water samples from upstream Hershey Run, but metals were detected in the following concentrations:

• Aluminum	1,510 ug/L
• Barium	111 ug/L
• Magnesium	9,120 ug/L

Midstream sediment samples were also obtained from Hershey Run and indicated concentrations of the following constituents:

• Anthracene	7,430 ug/kg
• Benzo(a)anthracene	2,060 ug/kg
• Benzo(a)pyrene	2,860 ug/kg
• Benzo(b)fluoranthene	2,230 ug/kg
• Benzo(k)fluoranthene	2,320 ug/kg
• Chrysene	2,990 ug/kg
• Fluoranthene	1,240 ug/kg
• Fluorene	896 ug/kg
• Phenanthrene	2,510 ug/kg
• Pyrene	1,750 ug/kg
• Aluminum	14,800 mg/kg
• Barium	161 mg/kg
• Lead	14 mg/kg
• Magnesium	4,890 mg/kg

PAHs were not detected in the surface water samples from midstream Hershey Run, but metals were detected in the following concentrations:

• Aluminum	3,420 ug/L
• Barium	69 ug/L
• Lead	5.7 ug/L
• Magnesium	10,200 ug/L

The presence of PAHs in both the upstream and the midstream sediment samples indicate the potential for an upstream source of PAHs. The concentrations of barium, lead, and magnesium detected in the upstream Hershey Run sediment sample are significantly higher than those detected in the midstream sample and may also indicate a potential offsite source of the metallic constituents.

3.5.2.2 White Clay Creek Sampling

Surface water and sediment samples were obtained from White Clay Creek at both upstream and midstream sampling points, as shown on Figure 3-2. The White Clay Creek samples did not reveal the presence of PAHs in either the upstream or midstream surface water or sediment samples. Metallic constituents detected in the upstream sediments included:

• Aluminum	14,600 mg/kg
• Barium	135 mg/kg
• Lead	33 mg/kg
• Magnesium	4,500 mg/kg

Metallic constituents detected in the midstream sediments included:

• Aluminum	23,400 mg/kg
• Barium	239 mg/kg
• Lead	84 mg/kg
• Magnesium	6,160 mg/kg

Upstream surface water samples revealed the presence of metallic constituents at the following concentrations:

• Aluminum	280 ug/L
• Barium	52 ug/L
• Magnesium	8,850 ug/L

Midstream surface water samples indicated metals at the following concentrations:

•	Aluminum	2,940 ug/L
•	Barium	101 ug/L
•	Magnesium	10,900 ug/L

3.5.2.3 Eastern Drainage Ditch Sampling

The eastern drainage ditch, labelled as Drainage Ditch 1A in the 1984 SI, was also sampled for PAHs and metals. Surface water samples from this area did not exhibit concentrations of PAHs. Sediment samples exhibited concentrations of the following constituents:

•	Benzo(a)anthracene	3,230 ug/kg
•	Benzo(a)pyrene	4,190 ug/kg
•	Benzo(b)fluoranthene	2,410 ug/kg
•	Benzo(k)fluoranthene	2,730 ug/kg
•	Chrysene	3,350 ug/kg
•	Fluoranthene	6,620 ug/kg
•	Phenanthrene	4,920 ug/kg
•	Pyrene	4,130 ug/kg
•	Aluminum	3,280 mg/kg
•	Barium	103 mg/kg
•	Lead	659 mg/kg
•	Magnesium	4,200 mg/kg

Surface water samples from the eastern drainage ditch exhibited concentrations of the following:

•	Aluminum	456 ug/L
•	Barium	80 ug/L
•	Lead	5.2 ug/L
•	Magnesium	7,620 ug/L

This drainage ditch apparently channeled surface water flow from the former processing areas across the Site.

3.6 POTENTIAL AREA OF CONCERN 5 - PROCESS DEBRIS AREA

Scattered process debris was noted throughout the areas labelled as PAOC 5 on Figure 3-1 during the March 1991 site visit. This debris includes process vessels, scrap material, piping, and other appurtenances presumably associated with the former Koppers operations. There is currently no information available on site conditions within PAOC 5, which will be further evaluated during the RI.

4.0 PRELIMINARY IDENTIFICATION OF ARARs

Criteria must be established to provide goals for the development of remedial objectives in the FS. These criteria will apply to the reduction of public and environmental risks, if present, and the attainment of applicable or relevant and appropriate requirements (ARARs). The ARARs will be applied to the various media of concern that may have been impacted by existing conditions at the Site, such as groundwater, surface water, soil, and sensitive environmental areas adjacent to the Site.

A detailed evaluation of the ARARs potentially applicable to Site conditions will be performed during the RI, and will be completed during the preparation of the FS. Based on the historical information available on existing Site conditions, a preliminary listing of ARARs can be developed.

Groundwater quality in the area may be evaluated under the requirements of the National Interim Primary and Secondary Drinking Water Standards, where applicable. Promulgated water quality guidance levels, such as EPA's Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), or relevant toxicological standards, may also be considered.

Surface water ARARs may include the Surface Water Quality Standards promulgated by the DNREC for the protection of aquatic life or sensitive environmental areas, if it is found that surface water on the Site has an adverse impact on the surrounding wetlands or surface water bodies.

Soil and sediment standards or criteria are currently not available. ARARs will be evaluated considering public health risk criteria relevant to the constituents of interest, and the potential exposure pathways present on the Site.

The potential impact of the Site on the wetlands and other sensitive environmental areas will be estimated using the above-referenced standards, where applicable, and an evaluation of the quality of the wetlands themselves. Remedial actions under federal guidelines in these areas will consider the effects of past and current Site materials on these sensitive habitats, evaluate the effects of potential remedial actions, weigh the benefits and impacts of potential actions, and plan mitigation to restore or compensate for unavoidable remedial effects on wetlands. Specific guidelines that may also be applicable include those outlined under Executive Order 11990, Protection of Wetlands, and 11998, Floodplain Management.

5.0 IDENTIFICATION OF POTENTIAL RECEPTORS

5.1 PURPOSE

This portion of the Work Plan presents a phase study that will identify potential receptors of the constituents of interest. Phase I investigation activities include the review of existing files and published documentation, a Site reconnaissance, a regulatory agency information search, an aerial photograph review, and a literature review of facility, State of Delaware, and county environmental references for the geographical area.

Phase II consists of characterizing natural communities at the Site and integrating existing information with new Site survey information to provide a comprehensive data base. Characterization may include wildlife survey of natural areas, wildlife habitat inventory and descriptions, and the description of potential habitats for rare, threatened, or endangered species.

Phase III investigations, if any, will be developed if specialized studies are required to evaluate actual effects upon individual potential receptors. The collection and assay of potential receptor organisms for known or suspected constituents may be used to confirm or disprove constituent migration pathways.

Work tasks for the potential receptors investigation are listed below under subject headings. Site familiarization/reconnaissance will precede execution of all of these technical tasks.

5.2 POPULATION DEMOGRAPHICS

Adjacent populations that may be impacted by the Site will be evaluated. Potential exposure pathways include groundwater, surface, and air. Air pathways are not considered a significant concern because the constituents of interest are not highly mobile through air. Dust generation is not considered a potential hazard because of the moist conditions and the extensive vegetative cover present at the Site.

The current water uses in the area are being characterized in the Water Resources reports from the Water Supply Plan for New Castle County, Delaware, detailed in the Churchmans Environmental Impact Study for years 1990 and 1991. This report details groundwater and surface water usages throughout New Castle County and is currently undergoing revision. Information from this report will be used to evaluate the potential exposure pathways along these routes.

5.3 GROUNDWATER RECEPTORS

The potential receptors of the constituents of interest in the groundwater in the vicinity of the Site will be investigated. Local uses and possible future local uses of groundwater will be identified by a review of project files and by contacting state and local regulatory agencies. Chemical characteristics of groundwater and physical descriptions of aquifers will be obtained by reviewing the extensive data files on groundwater that have been compiled over several years. Issues will include:

- Drinking water source and use (e.g., municipal or residential, agricultural, domestic/nonpotable, and industrial)

- Location of groundwater users and potential users within a 1-mile radius of the Site boundary, including wells and discharge areas

- Aquifer classifications within 2,000 feet of the Site boundary (Columbia and Potomac Formations)

Primary baseline information is found in DuPont Newport Superfund Site files, and additional information sources are DNREC, the Delaware Geological Survey (DGS), and the Delaware River Basin Commission (DRBC).

5.4 SURFACE WATER RECEPTORS

The potential receptors for surface water impacts from the Site will be identified by reviewing current and potential future uses of surface waters draining the Site or potentially affected by the Site. Surface water information will include:

- Domestic and municipal uses (e.g., potable and lawn/garden watering)

  Watersheds at the Site drain directly to the Christina River generally allowing no domestic or municipal use of Site surface water.

- Recreational uses (e.g., swimming, fishing)

  Surface water discharges to the Christina River allow for recreational water contact only through boating, fishing, or swimming in adjacent open and shoreline river waters.

- Agricultural uses (e.g., crops, farm animals)

  Restricted access to the Site allows no agricultural use of surface waters, except through the use of Delaware River water possibly along tidal creeks.

- Industrial uses

  Industrial use of adjacent Christina River water within 1 mile up- and downstream of the Site will be reviewed (DRBC and DNREC records).

- Environmental uses (e.g., fish and wildlife propagation)

  Potential receptors include Christina River, Hershey Run, and White Clay Creek fauna if Site runoff affects the adjacent waterbodies.

The surface water investigation will be performed by contacting federal, state, and local regulatory agencies, performing a literature search, and by reviewing maps, aerial photographs, and existing surface water and soil erosion management plans. Surface water sampling will also be performed as detailed under Section 7.0 to provide information on existing Site conditions.

5.5 AQUATIC ECOLOGY

5.5.1 Phase I

A review of existing information will be conducted to determine the biota in surface water bodies on, adjacent to, or affected by the Site. The following tasks will be performed:

- File information will be reviewed including the series of reports on the results of past and ongoing studies concerning the chemical characteristics of sediments and surface waters at or near the Site.

- State and federal agencies will be contacted for existing data on fish and invertebrates especially in the near shore Christina River and tributary streams within 2,000 feet of the Site.

5.5.2 Phase II

Little information exists for biota in the Site tributaries and for sediment-related organism exposures in the Christina River and Site tributaries.

After a complete review of existing data, if there is a lack of information for areas of potential aquatic habitat value and potential impacts, further investigations may be suggested to obtain the baseline information. These could include collection of benthic samples from onsite tributaries and the Christina River (sampling techniques are discussed below) and fish from onsite tributaries. Water and sediments will also be sampled and analyzed for the constituents of interest at the Site.

5.6 TERRESTRIAL ECOLOGY

5.6.1 Phase I

Existing file report information and information available from federal, state, and county agencies will be reviewed.

5.6.2 Phase II

As in the investigation of aquatic ecology, if after a complete review of existing data there is a lack of information for areas of potential wildlife habitat value and potential impacts, further investigations may be suggested to obtain the baseline information.

5.6.3 Phase III

If the comparison of known areas of migration (i.e., impacted soils) and the characterization of terrestrial habitats and species distribution indicates a probable affect upon a receptor species, then further investigation may be warranted to determine the potential impact. Collection methods will be as described in Phase II.

5.7 RARE, THREATENED, OR ENDANGERED SPECIES

5.7.1 Phase I

A review of updated Delaware Natural Heritage Program records will be performed, as well as a review of protected plant species.

5.7.2 Phase II

Select surveys of the Site may be warranted to document the occurrence of protected species, depending upon the status of the Phase I update and possible use of the Site area by protected species. Sampling procedures will follow those described as appropriate for qualitative methods.

5.8 ADDITIONAL INFORMATION

Cross referencing information gathered during Site investigations may further identify potential receptors present at or near the Site. Data collected pertaining to the water quality of the Christina River and area creeks, and recreational and economic uses of the bodies of water may provide additional information relevant to the potential receptors of possible releases.

5.9 QUALITY ASSURANCE PROJECT PLAN CONFORMANCE

Field data collection and analysis will follow the guidelines given in the Quality Assurance Project Plan (QAPjP) as appropriate. Sampling of physical media, sample quality assurance, and sample custody will be in accordance with the requirements outlined in the QAPjP and QAMS-005/80. The analytical program will apply for all physical samples.

6.0 REMEDIAL INVESTIGATION OBJECTIVES

6.1 OBJECTIVES OF THE REMEDIAL INVESTIGATION

In order to best utilize the data generated during the RI to support the decision making process, a clear definition of the RI objectives and procedures for data collection is required. The objectives of the proposed RI activities at the Site are to:

- Identify and characterize the nature and extent of the constituents onsite and offsite, environmental pathways, and potential receptors

- Assess the extent to which the detected constituents of interest pose a threat to the public health, welfare, or the environment. The results of this assessment will be used to evaluate the extent of remediation required at the Site.

- Produce appropriate and sufficient data to support the development and evaluation of remedial action alternatives

In order to accomplish these objectives, a series of tasks will be performed to collect and evaluate the necessary data on existing Site conditions and characteristics. The required tasks are outlined and detailed under Section 7.0.

6.2 DATA QUALITY OBJECTIVES

In order to achieve the information objectives of the RI, and to ensure that the data generated during the RI are sufficient for their intended use, RI field activities, including field sampling, monitoring well installation, and other relevant data gathering procedures, will be performed according to standard methodologies and protocols. The RI will be performed in accordance with the requirements of the Comprehensive Environmental Response, Liability and Compensation Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the National Oil and Hazardous Substance Contingency Plan (NCP), and the appropriate guidance documents.

Data generated during the RI will conform to acceptable protocols as defined under the EPA guidance document "Data Quality Objectives for Remedial Response Activities." This document will be used to determine the analytical levels required to produce data that can be confidently used. To ensure that the information obtained during the RI meets or exceeds the data requirements, Data Quality Objectives (DQOs) will be developed.

DQOs are based on the concept that different data uses may require differing levels of data quality and therefore relate the extent and quality of data to be gathered in the RI to the ultimate end use of the data. DQOs are defined with respect to types, numbers, and locations of samples that will be collected and the quality assurance levels associated with the analysis. They are set to clarify the level of uncertainty that a decision maker is willing to accept in drawing conclusions based on the data. Investigation activities at the Site will generate data from all DQO levels. Where data have multiple uses, the uses will be prioritized and assigned analytical levels for a particular use.

Level 1 data are typically not suitable to support risk assessment and alternatives evaluation but are used for field screening and health and safety monitoring. Level 2 analytical data may be used to evaluate remedial alternatives if they are accompanied by the appropriate QA/QC documentation.

Level 3 data are more acceptable for use in design of potential remedial alternatives than Level 2 data. Level 3 data can also be used as a basis for risk assessment. As with Level 3 data, Level 4 analytical data typically have quantitation limits that allow comparison with ARARs and support risk assessment and remedial alternative evaluation. The only difference between Level 3 and Level 4 data is that Level 4 analytical results are submitted with additional QA/QC deliverables, such as the GC/MS calibration record. Quantitation limits, surrogate recovery, and other relevant QA/QC information are the same for both data levels. The proposed DQOs for the sampling activities at the Site are identified in Table 6-1 and will be addressed further in the Quality Assurance Project Plan (QAPjP).

The Level 1 data generated at the Site will include field screening surveys using photoionization detectors (PID) or flame-ionization detectors (FID), and oxygen/ explosimeters. Field measurements of water levels and parameters such as pH, temperature, and specific conductivity are also examples of Level 1 data. This type of data is suitable for health and safety monitoring, evaluating placement of soil borings, and evaluating the adequacy of well development and purging procedures.

Onsite field screening of split-spoon samples will yield semiquantitative results of Level 2 quality and will be supported by Target Compound List (TCL) sample analyses. The analytical results of onsite and offsite surface water, sediment, and soil samples obtained by NUS during the 1984 SI are assumed to be Level 3 quality. This information is useful as guidance in evaluating potential areas of concern at the Site.

Laboratory analyses of selected samples from the Site will be performed to obtain Level 4 quality data. Other samples obtained from the site will be analyzed at a Level 3 degree of information. Level 3 and Level 4 data have standard detection limits and documentation suitable for the risk assessment and evaluation of potential remedial alternatives.

Level 5 data include nonconventional parameters, such as dioxins in soil, and geotechnical parameters, such as grain size analysis and Atterberg limits.

Approximately 20 percent of the data generated during the RI will be required to conform to the requirements outlined in the current Statement of Work for EPA Certified Laboratory Program (CLP) approved laboratories. These samples will be analyzed for TCL volatile organics, semivolatiles (base neutrals/acid extractables), pesticides, dioxins, and Target Analyte List (TAL) metals. This laboratory data, including Quality Assurance/Quality Control (QA/QC) sampling will be reviewed in accordance with the requirements of the Quality Assurance Project Plan (QAPjP) to ensure that the quality of data is acceptable for use in evaluating the potential impacts of the Site and potential remedial alternatives. Data of this quality conforms to the requirements of a Level 4 analysis.

The remaining samples obtained from the Site will require Level 3 data quality. These samples will be submitted for TCL volatile, semivolatile, and TAL metals only. This data will be correlated with the information obtained from the samples submitted for Level 4 analysis and will be used to evaluate the extent of the constituents of interest at the Site. The Level 3 analytical information will be used provide information on Site conditions, and will be used in designing remedial alternatives.

6.3 WETLAND/BIOLOGICAL RESOURCES

The objectives of the wetland/biological tasks are to:

- Gather baseline information including existing literature/information and supplemental Site investigations to adequately characterize Site communities and habitats and delineate their boundaries (Phase I)

- Coordinate remedial investigations of soil, surface, and groundwater to cover wetland areas in Phase I and II sampling

- Associate investigation results of Site constituent distribution with biological characterization to evaluate the need for further biological studies beyond Phase I

- Provide assessments of wetland/biological integrity (health) for areas of significant Site-related impact in Phase II sampling. Wetland/biological integrity will be evaluated in applicable terms of biological indicators as used by state and federal agencies. Wetland/biological integrity evaluation will be used as input to decisions on: the effects of past and current Site materials on sensitive habitats; the potential effects of remedial actions; and the balance of the benefits and impacts of potential actions.

The wetland and biological resource evaluation will be performed concurrently with the RI investigation activities. Field sampling results will be used to focus continued RI activities in the potentially sensitive areas adjacent to the former facility.

6.4 OTHER DATA COLLECTION

The data generated during the RI will be evaluated for completeness and acceptability as it is received from the laboratory. Approved data will be reviewed, and potential information gaps and additional requirements will be identified. The ensuing stages of the RI data collection and review activities will incorporate any additional data requirements identified after completion of the initial round of sampling. The proposed approach to performing the RI is discussed under Section 7.0 of this document.

7.0 REMEDIAL INVESTIGATION TASKS

7.1 INTRODUCTION

7.1.1 Site-Specific Statement of Work Tasks

This RI/FS will incorporate the tasks detailed in the Administrative Order on Consent for Remedial Investigation/Feasibility Study (Docket No. III-91-16-DC) Statement of Work (SOW) for this project. Nine tasks are specified in the SOW and are listed below:

- Task 1 - Scoping of the RI/FS
- Task 2 - Topographic Map Survey
- Task 3 - Community Relations
- Task 4 - Site Characterization
- Task 5 - Biological Characterization
- Task 6 - Risk Assessment
- Task 7 - Treatability Studies
- Task 8 - Development and Screening of Remedial Alternatives
- Task 9 - Detailed Analysis of Remedial Alternatives

Scoping of the RI/FS (SOW Task 1) was performed during the preparation of this Work Plan. The task involved review of background information relevant to historical site operations, disposal operations and land use, adjacent land use, and other pertinent data. Existing site conditions were also evaluated, and this information will be combined with the results of the background investigation to refine the Scope of Work for the RI. This task was performed during the preparation of this Work Plan.

SOW Task 3, Community Relations, is the responsibility of the EPA. EPA will prepare and implement a community relations plan for the Site, and Beazer and DuPont will provide assistance as necessary. SOW Task 6, Risk Assessment, is also the responsibility of the EPA and will be performed after the completion of the RI activities.

SOW Tasks 2, 4, 5, and 7 constitute the field investigation phase of the RI. SOW Task 2 requires the performance of a topographic survey to delineate existing site conditions and the preparation of a Site base map for recording future site activities. SOW Task 4, Site Characterization, includes the field investigation and sampling activities to be performed to determine the nature and extent of the constituents of interest at the site. SOW Task 5, Biological Characterization, includes identification of potential receptors at or adjacent to the Site, characterization of the wetland areas, and evaluation of the potential impact of the constituents of interest on the receptors. Finally, SOW Task 7, Treatability Studies, if required, will be performed as necessary to refine remedial alternative selection and analysis. The specific details for meeting the objectives of these tasks will be discussed further in the following sections.

SOW Tasks 8 and 9, Development, Screening, and Detailed Analysis of Remedial Alternatives, will be addressed under Section 9.0 of this Work Plan.

7.1.2 Remedial Investigation Work Items

Specific RI work items were developed by Dames & Moore to address the requirements of SOW Tasks 2, 4, 5, and 7. The purpose of this section is to provide an overview of key work items that will be performed during the RI. These activities will be conducted to delineate and characterize the potential source areas of concern at the Site and the pertinent natural environmental features of the Site that could be impacted by the constituents of interest. The major focus of this section will be on the Phase I RI activities, which will be used to more fully characterize existing Site conditions.

Work items to be performed under the Phase I RI include:

1. Preparation of a site-specific Health and Safety Plan
2. Site investigation
3. Sample analysis/validation
4. Data evaluation
5. Treatability studies
6. Remedial investigation reports

Preparation of the site-specific Health and Safety Plan (HASP), RI work item 1, will be completed prior to the initiation of field activities. After completion and approval, the HASP will be incorporated into the RI/FS Work Plan and become an integral part of this document.

Site investigation (RI work item 2) includes the field activities required under SOW Tasks 2, 4, 5, and 7, and actually consists of several tasks and investigations. These subtasks and investigations are discussed in Sections 7.3 through 7.8 and include:

- Site reconnaissance (including a topographic map survey) (SOW Task 2)
- Soil/sediment investigation (SOW Task 4)
- Surface water sampling (SOW Task 4)
- Hydrogeologic investigation (SOW Task 4)
- Wetland/biological resource delineation and evaluation (SOW Task 5)

For each of the field investigations conducted to comply with the requirements of SOW Tasks 4 and 5, the objectives, sample locations and depths, analytical parameters and general sampling procedures are described. The rationales for the locations, frequency, and analytical parameters are also discussed. Field investigations will be performed in accordance with applicable sections of the USEPA guidance document "Compendium of Superfund Field Operations Methods" (December 1987). Specific field methods and sampling techniques to be used in the field investigations will be presented in the Field Sampling Plan (FSP).

Procedures for sample analysis/validation and data evaluation, RI work items 3 and 4, will be addressed under Section 7.9 and 7.10. Treatability Studies (RI work item 5 and SOW Task 7), will be addressed under Section 7.11. RI report preparation, including monthly progress reports along with draft and final RI report preparation, will be addressed under Section 7.12.

7.1.3 Analytical Rationale

Pertinent compounds that may be present in Site environmental media (e.g., soils, groundwater, surface water/sediment, and possibly biological media) include:

- Volatile organic compounds (as related to the fuel oil)
- Base/neutral compounds (or PAHs)
- Acid extractable compounds (phenolics)
- Metals

Analyses for TCL volatile organics, semivolatile organics, pesticides, dioxins, and TAL metals will be performed on 20 percent of the samples obtained during the RI and will be analyzed according to Level 4 protocols for deliverables. The remaining samples will be analyzed for TCL volatile organics, semivolatile organics, and TAL metals only, using Level 3 protocols for deliverables. The analytical levels to be used during the RI are discussed under Section 6.0 of this document.

7.2 REMEDIAL INVESTIGATION APPROACH

The RI field investigation will be performed using a phased approach toward implementing the various activities. This approach will allow for a focused characterization of the various areas and media of concern, while providing the required level of data necessary to make decisions concerning the need for additional investigative activities. The approach to performing the various stages of the RI, with emphasis on Phase I field investigations, is outlined in the following sections.

7.3 SITE RECONNAISSANCE

7.3.1 Literature Search

A literature search will be conducted to further determine the history of operations at the Site, as well as gather environmental information. Whenever possible, persons associated with the Site will be interviewed as well. The literature search will include:

- FOIA -- Pursuant to the Freedom of Information Act (FOIA), a search will be performed to identify any other potential sources of the constituents of interest near the Site. The State of Delaware will be contacted to arrange for the file review. The regulatory files may include permits, sampling episodes, or historical reports.

- Aerial Photography -- Land use at the Site will be investigated using available historical aerial photographs. Aerial photos of pre-facility conditions may not be available; therefore, historical USGS topographic maps will also be obtained. The National Cartographic Information Center (NCIC) will be contacted for this information. Areas of soil disturbance or construction activity that may be related to the release or possible release of hazardous substances at or relating to the Site will be identified and mapped. Information from available documents, reports, and from former Site employees will be evaluated and relevant data presented to assist in providing information concerning areas of soil disturbance or construction activity. Efforts will be made to obtain any additional historical maps and photographs from Site owners or operators.

- Subsurface Utilities -- The owners of the property and local electrical, water, sewer, and telephone utilities in the area will be contacted to determine the location of subsurface utility structures beneath the Site. This will be completed before soil borings are performed.

4. Environmental Data -- Additional data that may be relevant to the former activities at the Site will be obtained. For example, the Delaware Department of Health may have water quality analyses of residential well and/or public water supply well water that can be compared to groundwater and surface water results obtained from the Site. In addition, studies on conditions in Churchman's Marsh, the Christina River, and White Clay Creek, if available, can be compared with surface water, sediment, and wetland results in areas onsite and adjacent to the Site.

7.3.2 Topographic Map Survey

A topographic survey will be conducted of the Site and adjacent areas that may have been impacted by the historical activities at the Site. A base map will be generated from this survey that will depict floodplains, topographic changes, and a historical review of manmade changes. All sampling locations, grids, wells, etc., will be plotted on the base map. The survey and mapping will be conducted by a licensed State of Delaware surveyor using the appropriate regional datum and grid coordinates. The maps will be prepared at an appropriate scale and in a reproducible format (i.e., mylar base or chronoflex). All succeeding maps prepared during the RI/FS will be prepared using the same grid coordinates.

7.3.3 Field Inspection

A field inspection of the Site will be performed in late summer or early fall to locate specific areas of stressed vegetation and visible staining. If necessary, a clearing and grubbing program will be implemented at specific areas throughout the Site to remove standing vegetation and provide a clearer view.

7.4 SOIL/SEDIMENT INVESTIGATION

Soil sampling will be conducted to determine background levels of metals (TALs) and other TCL compounds in the natural soil and to determine the nature and extent of constituents of interest at the Site. For sampling purposes, the Site soils will be divided into unsaturated (upland) soils and saturated (wetland) soils. Analytical results will be compared with background criteria for soils, such as USGS Professional Paper 1270.

Sediment sampling will be performed to characterize the concentrations of TCL and TAL parameters in the surface water bodies adjacent to and on the Site. The surface water bodies include Hershey Run, the Fire Pond, the South Ponds and the drainage ditches that discharge surface water across the Site to the Christina River, White Clay Creek, and Hershey Run. The purpose of these studies is to evaluate the potential for migration of the constituents of interest through surface water transport and to investigate potential concentration gradients across the Site.

Soil and sediment sampling activities will be performed according to the EPA guidance document "Compendium of Superfund Field Operations Methods" (December 1987). The methods and specific sampling techniques to be employed will be presented in the FSP.

A maximum of two soil samples will be obtained from each boring at the Site and submitted for analysis, depending on field conditions. Samples from the boreholes will be selected based on various criteria, such as the visible presence of the constituents of interest within the sample, or samples obtained from directly beneath visibly impacted sampling locations. The sample selection criteria will be augmented through the use of field-screening techniques, such as zero headspace analysis.

The analytical parameters and level of documentation associated with the soil and the sediment samples are outlined under Section 6.0 and 7.1.3. Approximately 20 percent of the total number of soil and sediment samples retained from the sampling locations will be submitted for analysis according to Level 4 protocols and documentation procedures. The remaining samples will be submitted for analyses under Level 3 protocols and documentation procedures.

7.4.1 Background Soil Survey

A background soil survey will be conducted to provide a statistical database for comparison and assessment of onsite versus natural constituent concentrations. The background soil samples will be obtained from onsite locations that do not appear to have been impacted by previous Site activities. The locations for background sampling will be determined following the Site reconnaissance. It is anticipated that three background locations will be selected and that two samples will be collected from each background locations for a total of six samples. The background samples will be submitted for laboratory testing of the full list of TCL volatile organics, semivolatiles (base neutrals/acid extractables), pesticides, dioxins, and TAL metals to establish a Site baseline.

7.4.2 Unsaturated (Upland) Soil Sampling Rationale

In upland areas of the Site, there are two PAOCs related to former operations that are of principal interest for soil investigation: PAOC 1 (Creosote Unloading area and Treatment area and Drip Tracks), and PAOC 2 (treated wood storage area). From information on past Site operations and data obtained during the 1984 SI, PAOCs 1 and 2 are known to have concentrations of PAHs and other constituents in the soil. Soil sampling activities will be performed in these areas of the facility, and also in the surrounding upland areas to delineate constituent concentrations (both vertically and horizontally). Detailed sampling and field-screening procedures will be presented in the FSP. Soil sampling below the water table will be performed at some locations in conjunction with monitoring well installations and is discussed under the hydrogeologic investigation (Section 7.6).

Soil borings in PAOCs 1 and 2 will be performed at the locations shown on Figure 7-1. Soil borings will be drilled using a trailer-mounted drill rig, a portable power auger, or other appropriate drilling equipment. Continuous split-spoon sampling to the water table (estimated depth of 10 feet) will be performed to characterize the vertical soil profile. Soil samples will be selected for laboratory analysis based on field screening with PID and FID instruments and/or the physical appearance of the soil. A maximum of two samples will be obtained from each borehole.

The soil samples obtained from this area will be analyzed for the parameters and at the frequency outlined under Section 7.1.3. In addition, the leaching/adsorptive characteristics of the soil will be evaluated through geotechnical tests (e.g., cation exchange capacity of the soil strata). Analytical results of soil sampling will be assessed in conjunction with the groundwater quality data to determine the need for additional soil borings and/or groundwater monitoring wells to adequately define source areas.

7.4.3 Saturated (Wetland) Soil Sampling Rationale

The wetlands in the southern sections of the Site will be sampled at the locations shown on Figure 7-1. These sampling points were selected to provide information on the migration pathways of the constituents of interest through surface water flow across the Site. Specific sampling requirements for the drainage ditches through these areas are presented under Section 7.4.4.

Soil sampling in wetlands will be modified to account for soil differences and adjusted for tidal water flows. Thin wall core or sidewall samplers will be used in tidal marsh sediments rather than standard split-spoon samplers. Samples from the wetland areas will be obtained at intervals of 0 to 6 inches and 6 to 12 inches below grade.

The samples obtained from this area will be analyzed for the parameters and at the frequency outlined under Section 7.1.3. Supplemental parameters in wetland soils will include percent organic carbon, sand, silt and clay content, pH, Eh, and conductivity. Analytical procedures will be the same as in unsaturated soil sampling and analysis.

7.4.4 Sediment Sampling Rationale

Sediment samples will be collected in the locations shown on Figure 7-1. These areas were selected based on the sediment sampling results obtained during the 1984 NUS SI and on an evaluation of surface water discharge pathways across the Site to the Christina River and White Clay Creek. Major surface water flow pathways appear to discharge along the eastern drainage ditch, along the drainage ditches in the southern portion of the Site, and to the west to Hershey Run. Sediment sampling locations were selected to evaluate these areas as potential migration pathways for the constituents of interest. Samples will also be obtained to characterize the sediments present in the Fire Pond and the South Ponds.

7.4.4.1 Fire Pond and South Ponds Sampling

Four sediment samples will be obtained from the Fire Pond, and three from the South Ponds, as shown on Figure 7-1. The sediment samples will be analyzed for the parameters and at the frequency outlined under Section 7.1.3. The results will be used to evaluate the potential presence of the constituents of interest at these locations.

7.4.4.2 Hershey Run Sampling

Sediment/soil samples will be obtained along three transects perpendicular to Hershey Run: Transect 1, at the northern property boundary of the Site; Transect 2, along the midstream section of Hershey Run; and Transect 3, near the discharge point to White Clay Creek. Sediment samples will be obtained at four points along each transect: two along the banks of Hershey Run, and two along the base of the stream. A total of 12 sediment samples will be obtained from Hershey Run.

The sediment samples will be analyzed for the parameters and at the frequency outlined under Section 7.1.3. Analytical results of the sediment samples will be used to evaluate potential concentration gradients along Hershey Run, and the extent of tidal influence upstream of the Christina River on constituent transport. The analytical results may also indicate the potential impact of offsite sources on the concentrations of constituents.

7.4.4.3 Eastern Drainage Ditch Sampling

Sediment samples will be obtained from the eastern drainage ditch to evaluate the potential presence of the constituents of interest near the Christina River. Six samples will be obtained from this ditch as shown on Figure 7-1. The sediment samples will be analyzed for the parameters and at the frequency outlined under Section 7.1.3. Supplemental parameters will include: percent organic carbon, sand, silt and clay content, pH, Eh, and conductivity.

7.4.4.4 Drainage Ditches Sampling

The major drainage ditches in the southern section of the Site will be investigated to evaluate their significance as pathways to the Christina River and White Clay Creek. Sediment samples will be collected at six locations along these ditches, as shown on Figure 7-1. The sediment samples will be analyzed for the parameters and at the frequency outlined under Section 7.1.3. Supplemental parameters will include: percent organic carbon, sand, silt and clay content, pH, Eh, and conductivity.

7.4.5 Potential Phase II Soil/Sediment Investigations

If the results of the soil/sediment sampling do not adequately delineate the extent of impact of the constituents of interest, then a Phase II soil/sediment sampling program may be required. This may involve the collection and analysis of additional soil/sediment samples to further delineate specific areas of concern and/or to define concentration gradients.

7.5 SURFACE WATER SAMPLING ACTIVITIES

7.5.1 Phase I Surface Water Sampling

Surface water sampling will be performed in conjunction with the sediment sampling activities where feasible. Surface water sampling activities will be performed according to the EPA guidance document "Compendium of Superfund Field Operations Methods" (December 1987). The methods and specific sampling techniques to be employed will be presented in the FSP.

Surface water samples will be collected at the locations where sediment samples are collected. Only one corresponding surface water sample will be obtained at the three transects across Hershey Run. Collection of surface water samples may not be possible in some of the drainage ditches because of a lack of water. The surface water samples will be analyzed for the parameters and at the frequency outlined under Section 7.1.3.

7.5.2 Phase II Surface Water Sampling

If the results of the surface water sampling do not adequately delineate the extent of impact of the constituents of interest, then a Phase II surface water sampling program may be required. This may involve the collection and analysis of additional surface water samples to further delineate specific areas of concern and/or to define concentration gradients.

7.6 HYDROGEOLOGIC INVESTIGATION

A hydrogeologic investigation will be conducted to identify the nature and extent of the constituents of interest in groundwater. Some of the constituents identified at the Site, particularly the PAH compounds, tend to adsorb strongly to soil and are not readily transported through the unsaturated zone into the underlying groundwater. Information on groundwater quality beneath the Site is currently unavailable.

The hydrogeologic investigation will be phased with the data requirements and may be expanded if evidence of impact from the Site on the groundwater quality is found. The first phase of the investigation, discussed in Section 7.6.1, will evaluate whether the constituents of interest are present in the water table aquifer (fill material and/or Columbia Formation). If an impact on the groundwater is found, then a second phase of investigation, discussed in Section 7.6.2, will be conducted to: (1) evaluate the extent of the constituents of interest in the water table aquifer; (2) evaluate the presence of the constituents in the underlying hydrologic zones of the Potomac Formation; and (3) characterize the groundwater flow patterns and velocities in the Columbia and Potomac Formations. This information will be used to evaluate remedial action alternatives, if necessary.

7.6.1 Phase I Evaluation of the Water Table Aquifer

The objectives of the Phase I investigation will be to evaluate the extent and magnitude of constituents of interest in the water table aquifer, groundwater and constituent migration pathways in the water table aquifer, and the potential impact from adjacent properties on Site groundwater.

The rationale for the screened intervals and placement of monitoring wells in the water table aquifer is discussed in Section 7.6.2. General monitoring well installation procedures, groundwater sampling, and water level measurement procedures are presented in Appendix A of this document.

7.6.2 Rationale for Phase I Wells Screened in the Water Table Aquifer

Eleven Phase I monitoring wells (MW-1 through MW-11) will be installed at locations (see Figure 7-2) selected to evaluate groundwater quality in the water table aquifer. The proposed monitoring well locations and the rationale for placement are as follows:

- MW-1 - to assess groundwater quality potentially impacted by upgradient, offsite activities
- MW-2 - to assess groundwater quality near downgradient edge of former Treating Building
- MW-3 - to assess groundwater quality near downgradient edge of Drip Tracks
- MW-4 - to assess groundwater quality potentially impacted by industrial activities east of the Site
- MW-5 - to assess groundwater quality downgradient of PAOCs 1 and 2
- MW-6 - to assess groundwater quality near downgradient edge of Treated Wood Storage area
- MW-7 - to assess groundwater quality potentially impacted by industrial activities to the east of the Site
- MW-8 - to assess groundwater quality in wetlands areas downgradient of former processing areas, and to evaluate groundwater quality discharging to White Clay Creek
- MW-9 and MW-10 - to assess groundwater quality within the Treated Wood Storage area

- MW-11 - to assess groundwater quality discharging to Hershey Run

The locations shown in Figure 7-2 are approximate and may change because of Site conditions.

In addition to the wells listed above, a pre-existing monitoring well (MW-27A), installed by DuPont in conjunction with the ongoing investigation of the adjacent DuPont Newport Superfund Site, will be used as an additional control point to provide water level data and water quality data in the water table aquifer and to provide water quality information on groundwater discharging to the Christina River.

The saturated thickness of the Columbia Formation is estimated to vary between 15 and 30 feet, based on information from the DuPont Newport Superfund Landfill (DuPont Landfill) study (WCC 1987). If the lower hydrologic zone of the Potomac Formation subcrops beneath the Columbia Formation, then the water table aquifer may extend to some depth. However, if the clayey Middle Potomac Formation subcrops beneath the Columbia Formation, then the water table may be underlain by this possibly confining layer.

Three exploratory borings will be drilled at the locations of MW-1, MW-5, and MW-8 (Figure 7-2) to a maximum depth of 60 feet. Samples will logged continuously from these borings to determine whether or not the Columbia Formation is underlain by the clayey zone of the Middle Potomac Formation. If this unit is observed, then water table wells only will be installed at each monitoring well location. These will be constructed using a 10-foot length of well screen intersecting the water table in each well.

In the event that a possible confining layer is not observed in the exploratory boring, and the water table extends to the explored of 60 feet, then deeper wells will be installed adjacent to the water table wells. These will be constructed using a 5-foot length of well screen in each well set from a depth of approximately 55-60 feet.

Information obtained from the exploratory borings and deep wells will be threefold. Examination of the soil samples collected from the exploratory boring will be used to visually estimate the stratigraphic and hydrologic characteristics. Piezometric data from the shallow and deep well couplets (if deep wells are installed, as per the criteria outlined above) will be used to evaluate whether the vertical component of groundwater flow is downward or upward in the water table aquifer. Water level data from all the wells will be used to produce potentiometric elevation contour maps to assess the lateral groundwater flow directions.

7.6.3 Phase II Investigation

The need for a Phase II hydrogeologic investigation will be evaluated after the results of the groundwater samples from the Phase I wells have been obtained. The scope of the Phase II work will depend on the pattern of groundwater quality determined in Phase I and will be described in detail in a Phase II work plan to be submitted to the EPA. Recommendations for additional investigations, if necessary, will be provided in the Phase I report.

Phase II RI activities have not been included in the preliminary schedule included with this Work Plan. If Phase II investigation activities are required, a separate work plan for the performance of field activities will be prepared and submitted to EPA for review and approval.

The Phase II hydrogeologic investigation will focus on, but will not be limited to, the following elements: (1) refinement of the estimate of horizontal and vertical migration of constituents in the water table aquifer; (2) evaluation of confining layers, if delineated; (3) *exploration and monitoring confined aquifer zones of the Potomac Formation*; (4) evaluation of interactions between the water table aquifer and surface water bodies and between the water table aquifer and deeper, confined aquifers; and (5) evaluation of migration patterns and potential for constituents in the water table and/or deeper aquifer.

To accomplish the Phase II investigation, supplementary water table wells may be necessary, in addition to ells set deeper in the water table aquifer, and/or set in delineated zones of the Potomac Formation. Additional exploratory borings may be necessary to delineate Potomac Formation aquifer zones. Pump and/or slug tests may also be performed at selected wells to evaluate the water table and Potomac aquifer characteristics. Activities will be conducted so as to minimize the potential for cross-contamination between the water table and deeper aquifers.

7.7 WETLANDS/BIOLOGICAL RESOURCES

Wetland/biological Site investigations will be coordinated with investigations of other Site media. The objective of these investigations will be to evaluate the potential impact on sensitive site ecological and biological receptors.

A comprehensive characterization of communities and habitats from existing information, review of historical aerial photos, and Site reconnaissance/verification will be performed during Phase I sampling. This will include a wetland delineation, by which wetland communities are evaluated in the field and delineated on the base map. Site wetlands will be delineated according to the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1989), and a preliminary report will be prepared for submission to the Corps of Engineers for a jurisdictional determination. Wetlands will also be classified and characterized according to the United States Fish and Wildlife Service system. The wetland characterization will include a description of sensitive plant or wildlife habitats observed within the wetlands.

Actual quantitative investigations of wetland/biological integrity (value and function) conducted in Phase II will be developed on the basis of Phase I sampling results (EPA

1989). Only areas of significant impact will initially be considered for biological investigation. Methods for integrity assessment will be developed following the identification of locations, communities, and constituents of interest.

Generally, the use of sessile benthic invertebrates as indicators of community integrity has been found to be more sensitive than plant indicators for water borne constituents. A survey of plant community species composition, species diversity, seasonal aboveground productivity, and underground reserves may be appropriate methods for assessing the effects of constituents of interest in wetlands in the later stages of an investigation, when more is known about the Site and wetland. However, benthic macroinvertebrate indicator surveys are more often used as a singular investigatory method.

The EPA has been developing benthic invertebrate indicator methodologies in refining water quality standards, assessing the integrity status of wetlands nationally, and in refining water quality monitoring programs (Rapid Bioassessment Protocols - RBP, Plafkin, et. al. 1988). DNREC, along with other state agencies, has recently established an interest and regulatory approach in using benthic invertebrates as biological indicators. A standard method for the rapid assessment of benthic resources (DNREC 1991) has been incorporated into new state marina regulations and in proposals for a statewide monitoring database.

This method, with modifications for this type of Site, is proposed for use in this investigation due to its widespread use and acceptance, as well as consistency with State of Delaware and EPA programs. A full description of the methodology is discussed under Section 5.0 of this document and will be detailed in the FSP.

Biotic indices may be calculated using the associations of species with general water quality (Plafkin, et. al. 1988). Species are generally placed in the following categories:

- Tolerant - Organisms frequently associated with gross impacted and generally capable of thriving under anaerobic conditions

- Facultative - Organisms having a wide range of tolerance and frequently associated with moderate levels of organic impact

- Intolerant - Organisms not found associated with even moderate levels of organic constituents and generally intolerant of even moderate reductions in dissolved oxygen

Benthic macroinvertebrates are generally sessile (stationary). Through a ranking of their water quality tolerance, they are commonly used as indicators of recent water quality conditions or trends. In this way, they should be the best aquatic biologic indicator of current water quality in relation to past and current sediment and water quality constituents on the Site.

7.8 FIELD QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

7.8.1 Quality Control Sampling

The collection and testing of quality control samples will constitute a significant portion of the field activities. Detailed quality assurance/quality control procedures will be contained in the Quality Assurance Project Plan (QAPjP). The proposed analytical program includes QA/QC samples such as duplicate, field blank, trip blank, and matrix spike/matrix spike duplicate (MS/MSD) samples.

- Field duplicate samples will be collected at a frequency of approximately 10 percent or 1 per 20 or less samples for soil, groundwater, and surface water and will be tested for the same analytical parameters as the original samples. Field duplicate samples will not be collected for sediments.

- Field blank or equipment rinsate samples will be collected on each sampling day for each matrix and each analytical parameter at an approximate frequency of 10 percent for groundwater, surface water, soil, and sediment samples and will be tested for the same parameters as the original samples.

- Trip blank samples will be included with each shipment of aqueous organics samples and will be tested for TCL VOCs.

7.8.2 Sample Containers

Sample containers will be obtained from an EPA-approved laboratory. These bottles will be prepared, cleaned, labeled, stored, and quality controlled according to EPA guidelines. This involves analysis/testing of one or more representative containers from each lot or batch after they have been cleaned, and designating a storage QC container for testing at a future time if quality degradation of the containers is suspected. All storage QC containers should be kept in a separate, organic-free area.

If the sample bottles are stored at the Site in trailers during the field investigation, the storage area will be monitored in the same manner as the provider of the containers monitors the bottles. Also, the containers will be kept sealed and as far as possible from solvents. Ideally, solvents should be kept in separate housing than the containers and blank water.

7.8.3 Chain-of-Custody

Samples are identified by using a standard sample tag that is attached to the sample container. In some cases, particularly with biological samples, the sample tag may have to be included with or wrapped around the sample container and waterproofed. The sample tags are sequentially numbered and are accountable documents after they are completed and attached to a sample or other physical evidence. The following information will be included on the sample tag:

- Site name
- Field identification or sample station number
- Date and time of sample collection
- Designation of the sample as a grab or composite
- Type of sample (matrix), and a brief description of the sampling location
- Signature of the sampler
- Indication of whether the sample is preserved or unpreserved
- General types of analyses to be conducted

The chain-of-custody record will accompany the samples at all times and will be used to record the custody of samples. The following information will be supplied to complete the chain-of-custody record:

- Project name
- Signatures of samplers
- Sampling station number, date and time of collection, grab or composite sample designation, and a brief description of the type of sample and sampling location
- Tag numbers
- Signatures of individuals involved in sample transfer; i.e., those involved with relinquishing and accepting samples. Individuals receiving the samples shall date and note the time that they received the samples on the form.

Sample analysis request sheets serve as official communication to the laboratory of the particular analyses required for each sample and provide further evidence that the chain-of-custody is complete.

Shipping containers will be secured by nylon strapping tape and EPA custody seals to ensure samples have not been disturbed during transport. The custody seals will be placed on the containers so that the containers cannot be opened without breaking the seal.

7.8.4 Split Samples

If requested, selected samples will be split between the RI contractor and EPA's oversight contractor. It is assumed that the EPA will make the decision on which samples will be split in the field. If split sampling is required, EPA or EPA's oversight contractor will be responsible for supplying their own bottles, chain-of-custody forms, and sample transport containers.

7.8.5 Instrument Calibration

A discussion of field instrumentation will be provided in the FSP. Field instruments include, but are not limited to, PIDs, FIDs, pH meters, conductivity meters, water level probes, turbidity meters, etc. For example, in calibrating pH meters, the meter will be checked before each day of use with a minimum of two buffers. The probes will be rinsed after use with deionized water.

All maintenance and calibration records for field equipment will be traceable through field records to the person using the instrument and to the specific piece of instrumentation. Equipment will be labeled with the date of the last calibration.

7.8.6 Field Decontamination Procedures

The field and equipment preparation decontamination procedure for all sampling equipment is as follows:

1. Wash and scrub with laboratory detergent
2. Rinse with tap water
3. Rinse with 10 percent HNO_3 (nitric acid); use 1 percent HNO_3 for carbon-steel split-spoon samplers
4. Rinse with tap water
5. Rinse with methanol followed by hexane (use pesticide grade or better solvent)
6. Rinse with deionized water (demonstrated analyte free)
7. Air dry
8. Wrap in aluminum foil (shiny side out) for transport

All decontamination should be done in a laboratory prior to going into the field, and equipment should be dedicated to each sampling point. If this is not possible, equipment will be cleaned once a day offsite and dedicated each day. When sampling, cleaned equipment will be placed on polyethylene sheeting, but will not be wrapped in the sheeting for any reason. Samplers will change disposable gloves between wells or sampling points. The demonstrated analyte-free water will be stored away from solvents.

All drilling equipment and well casings must be steam cleaned before use, and the drilling equipment must be steam cleaned between boreholes. All types of heavy sampling equipment such as dredges should be cleaned with soap and deionized water or steam-cleaned before sampling begins and between sampling locations.

The decontamination procedure for dioxin sampling is the same as for TCL or TAL compounds, with the exception that the final equipment rinse is performed using 1,1,1-trichlorethane, as specified under the "Compendium of Superfund Field Operations Methods" (EPA December 1988).

7.8.7 Disposal of Wastes

Aqueous or solid wastes may be generated during the field investigation activities, and may include drill cuttings from the well borehole drilling process, water from the potentially impacted aquifer that will be pumped out during well development and during pump test activities, and decontamination waters generated during sampling and well installation procedures.

Drill cuttings will be drummed, labeled, and stored until soil quality and/or water data are received. Similarly, pumped water will be drummed. Based on analytical tests, the water will be disposed of in accordance with applicable regulations.

7.8.8 Documentation

Field records for the Site will be maintained by Dames & Moore. Sample collection and handling as well as visual observations will be documented in the logbooks. Sample collection equipment, field analytical equipment, and equipment utilized to make physical measurements will be identified in the logbooks. Calculations, results, and calibration data for field sampling, field analytical, and field physical measurement equipment will also be recorded in the logbook. Entries will be dated and initialed and will be legible.

7.9 SAMPLE ANALYSIS AND VALIDATION

Selected soil, groundwater, and surface water/sediment samples to be collected during the field investigation will be analyzed according to EPA CLP procedures for Level 4 DQO documentation protocols, as outlined under Section 7.1.3. The remaining samples obtained during the RI will be analyzed according to Level 3 documentation protocols. The data generated will be validated according to EPA Region III data validation procedures. The data validation will verify that the methods used to obtain analytical results followed the protocols specified in the FSP, and the analytical results are of sufficient quality for performing the risk assessment, selecting and screening potential remedial action alternatives, and supporting a Record of Decision (ROD) for the Site.

All samples collected during the RI, and then analyzed through the CLP, will be subjected to data validation using the following EPA Region III procedures:

- CLP Organics Data Review and Preliminary Review SOP No. HW-2 Revision No. 6, March 1989 (USEPA Region III 1989), or the most current version
- Evaluation of Metals Data for the Contract Laboratory Program, SOP No. HW-2, Revision No. 8, December 1988 (USEPA Region III 1988), or the most current version

Validation of analytical data will be performed by experienced chemists whose data validation packages have previously been accepted by EPA Region III and DNREC. Additional information on sample collection, analytical methods, detection limits, and QA/QC samples will be provided in the QAPjP for the RI.

7.10 DATA EVALUATION

This task includes review of existing data for the Site that were not available at the time of preparation of this Work Plan. Data collected during previous sampling events performed by others at the Site, and the data to be collected during this RI, will be organized, reviewed, and carefully evaluated to satisfy the objectives of the investigation. The data will be analyzed to evaluate Site impacts, identify groundwater flow directions, evaluate potential constituent sources, and describe Site geology and hydrogeology. When feasible, the data evaluation task will be performed concurrently with the field investigation, and sample analysis/validation.

Field data and laboratory analytical data will be entered into a data base. Boring logs will be prepared for all completed borings, and stratigraphic information developed from Site borings will be displayed as cross sections of the Site. Water level evaluations will be used to develop plot(s) of piezometric surfaces, if possible. Hydraulic gradients will be evaluated as appropriate. The analytical data for each medium sampled will be tabulated to illustrate the distribution of detected constituents of interest.

These data will be evaluated to determine the need for subsequent investigation. Data that have been validated in accordance with the applicable QA/QC requirements will be submitted to EPA with the monthly RI progress reports. This submittal will include tables and figures, well logs and geologic cross sections, and a description of Site geology and hydrogeology. A short bulleted list of the major findings of the investigation will be prepared. The list will be limited to those media that were found to be impacted, the most prevalent compounds, and the extent of detected impacts. A detailed evaluation of the geology/hydrogeology, analytical data, comparison to ARARs, and remedial alternatives will be presented as part of the RI and FS reports.

If a Phase II investigation is necessary based on the submitted data a scope of work will be developed as part of the Phase II project planning task, and a Phase II implementation document will be prepared and submitted to EPA for review and approval. If Phase II work is not needed, the project will proceed directly to the risk assessment, RI report, and FS.

7.11 TREATABILITY STUDIES (Optional)

If remedial action at the Site is deemed necessary based on the results of the RI, existing Site data and available literature or technologies will be reviewed to determine whether existing data are sufficient to evaluate remedial alternatives. If sufficient data to allow treatment alternatives to be developed and evaluated do not exist, treatability studies will be conducted as needed.

If necessary, laboratory or pilot-scale studies, or both, will be conducted to evaluate the applicability of remedial technologies to Site conditions. An analysis of the technologies will be conducted to evaluate the testing requirements. This analysis will be based on literature review, vendor contacts, and past experience.

A testing plan will also be developed, if necessary, that identifies the types and goals of the studies, the level of effort required, and data management and interpretation guidelines. The testing plan will be submitted to EPA for review and approval. Upon completion of the testing, the results will be evaluated to assess the technologies with respect to the site-specific questions identified in the test plan. A report will be prepared and will include a summary of the testing program and its results.

7.12 REMEDIAL INVESTIGATION REPORTS

7.12.1 Monthly Progress Reports

Monthly progress report will be prepared to describe the technical progress of the work. These reports will discuss:

- Site activities
- Status of work at the Site and the progress to date
- Analytical results of sampling activities, if available
- Schedule status and percentage of completion
- Difficulties encountered during the reporting period, and actions taken to resolve difficulties
- Scheduled activities for the next reporting period
- Action items to be completed by all parties

The progress report will list target and actual completion dates for each activity, including project completion, and will provide an explanation of any deviation from the schedule provided in the Work Plan.

7.12.2 Draft Remedial Investigation Report

The results of the RI field activities will be correlated and evaluated to determine the potential extent of impact, if any, of the constituents of interest on the air, surface water, soil, sediments, and groundwater at the Site. The information obtained during the RI will be presented in a report that will include the following:

- Site history and description
- Summary of previous investigations

- Executive summary presenting the findings and the conclusions of the field investigations
- Narrative summary outlining the field activities, including any problems or modifications in field procedures
- Analytical results of field sampling activities
- Monitoring well and soil boring logs
- Topographic survey data
- Delineation and evaluation of existing wetland areas on the Site
- Soil and sediment sampling locations
- Groundwater sampling and water table elevation results
- Identification of potential receptors
- Findings and conclusions of the RI
- Recommendations for additional investigations, if necessary

This information will be presented in the main body of the RI report. Maps and figures will present the field sampling and monitoring locations, results of sampling, and other relevant information. Summary tables will present the analytical results of the RI. Conclusions and recommendations will be based on the tabulated results, and additional field activities, if any, will be identified. The draft report will be submitted to EPA for review and comment.

7.12.3 Final Remedial Investigation Report

After receipt of EPA's comments on the draft RI report, revisions will be made to the draft document, and a final report will be submitted for EPA's review and approval.

8.0 DATA MANAGEMENT AND REPORTING

8.1 OBJECTIVES

Effective data management will ensure that the data generated during the RI field activities are prepared and presented in a format compatible with their intended uses. The objectives of the data management program for the RI are as follows:

- To provide the methodology to be followed for data collection, storage, tracking, and validation (quality control)
- To specify the types of data to be managed and the format of data storage
- To identify both a paper copy and electronic format storage system for field and laboratory data
- To document and track the investigation data collected during the RI
- To allow for quick access and easy retrieval of project data and provide flexibility in generating various display output formats, such as tables, figures, or graphs

Data management objectives will be met through the use of a formal data management program, using computerized spreadsheets for tabulation of the generated data, a database for interpretation and trend analysis of the data, and other specialized software, such as contouring and/or graphics programs.

Data generated during the RI field activities will be used to evaluate the presence of the constituents of interest at the sample locations, the horizontal and vertical extent of the detected constituents, and the characteristics of the subsurface materials that may influence constituent movement and affect potential remedial alternatives. Data evaluation will include:

- Data management, reduction, and tabulation
- Development of maps and figures outlining the areas of sampling and areas of potential concern
- Environmental transport and fate evaluation

Data reduction activities will be performed in a manner consistent with the requirements outlined in the QAPjP.

8.2 DATA MANAGEMENT

Field sampling and analytical procedures for the acquisition and compilation of field and laboratory data are subject to data management procedures. Data management procedures are necessary for field activities, sample management and tracking, and document control and inventory. The Data Quality Objectives (DQOs), outlined in the EPA guidance document "Data Quality Objectives for Remedial Response Activities," will govern the data management procedures used.

This section outlines the internal data management protocols that will be used to process and manipulate information generated during the RI. These management activities are designed to:

- Monitor the progress of the field activities
- Document and track the data obtained from field sampling activities
- Ensure the quality of the RI data by allowing detection of data anomalies
- Ensure data completeness, accuracy, and reproduceability
- Organize data for evaluation and tabulation

Internal data management will provide a consistent, structured approach for the processing and evaluation of RI data. Management practices will include the use of standardized field data collection forms and procedures, use of database management systems to store RI data, and graphics programs for generation of tables, figures, and other presentation graphics.

8.2.1 Recordkeeping Requirements

The following information will be generated and tracked during the RI:

- Study Area Locations and Ambient Conditions -- Prevailing environmental conditions and other observations that may impact the collection of field information in the separate areas of concern during RI activities will be recorded to evaluate the potential impact on data
- Field Activities Chronology -- A continuous record of field activities will be maintained throughout the course of the RI to provide a record of field decisions and a history of Site activities
- Soil Boring, Well Drilling, and Well Installation Logs

- Groundwater Elevation Records

- Collection of Samples -- including sample time, location, ambient conditions, and other relevant information

- Analytical Results -- to be incorporated with and compared to the conditions at the time of sampling

Maintenance of continuous records on the above information will provide a chronology of RI activities, and the potential impact of ambient environmental conditions on the data obtained during the RI. Field logs and notes will be maintained on standard forms and notebooks only, while analytical information will be entered into a database format.

8.2.2 Field Data Recording

During Site characterization and sampling, consistent documentation and accurate recordkeeping procedures will be maintained because subsequent decisions will be made on the basis of information gathered during these tasks. Aspects of data management for sampling activities during Site characterization will include:

- Quality Assurance/Quality Control (QA/QC) Plans -- These documents provide records of responsibility, adherence to prescribed protocols, nonconformity events, corrective measures, and data deficiencies. QA/QC plans will be discussed in detail in the QAPjP.

- Data Security System -- This system will include measures to be taken in the field to safeguard chain-of-custody records and prevent free access to project records, thereby guarding against accidents or loss, damage, or alteration. The Data Security System will be discussed in detail in the QAPjP.

- Field Logs -- The daily field logs will be the primary record of field investigation activities and will include a description of any modifications to the procedures outlined in the work plan, field sampling plan, or health and safety plan, with justifications for such modifications. Field measurements including pH, temperature, conductivity, water flow rates, air quality parameters, soil characteristics, and field observations will be recorded directly onto project log sheets. Health and safety monitoring, sampling locations, sampling techniques, and a general description of daily activity will be included in the daily log. Any unusual occurrences or circumstances will be documented in these logs and will be used for reference in determining the possible causes for data anomalies discovered during data analysis. Data will be recorded directly and legibly onto project sheets. Changes made to original notes will not obliterate the original information and will be dated and signed. Standard format information sheets will be used whenever appropriate and will be retained in permanent files. Samples of standard Dames & Moore logs and a discussion of each use will be provided in the QAPjP.

Documentation involved in maintaining field sample inventories and proper chain-of-custody records may include the following:

- Sample identification matrix
- Sample tag
- Chain-of-custody form
- Notice of transmittal

Specific data collection and recording requirements will be described in the field SOPs of the QAPjP.

8.2.3 Sample Management and Laboratory Data

A record of sample shipments, receipt of analytical results, submittal of preliminary results for QA/QC review, completion of QA/QC review, and evaluation of the QC package will be maintained to ensure that only final and approved analytical data are used in the Site analysis. In some instances, the use of preliminary data may be warranted to prepare internal review documents, to begin data analysis while minimizing time for the turnaround of QA/QC comments, or to continue narrowing remedial action alternatives. Preliminary data used in analyses will be updated upon receipt of official QA/QC comments and changes. Sample results will not be incorporated in the Site characterization report unless accompanied by QA/QC comments.

The DQOs for each task involving sample analysis specify whether the information is valid with qualifiers and specify which qualifiers can invalidate the use of certain data. Acceptability of data quality is not established until the reviewed QA/QC package accompanies the analytical data.

The acceptable QA/QC package will be defined in the approved Site QAPjP for each task. Nevertheless, the DQOs outlined for the use of the data will dictate the level of review required.

Sample results will be managed in a standardized form to promote easy reporting of data in the Site characterization report. Precautions will be taken in the analysis and storage of the data collected during Site characterization to prevent the introduction of errors or the loss or misinterpretation of data.

8.2.4 Data Storage and Organization

8.2.4.1 Written Documentation

A central project data filing system will be established prior to the initiation of RI field activities. Field notebooks will be organized chronologically, as will the chain-of-custody records. Preprinted field records will be organized by sample location or well. All records will be retained as part of the project file after the completion of field activities.

8.2.4.2 Computerized Files

Information such as analytical results, groundwater elevations, and other data typically reported in tabular format will be entered into a computerized spreadsheet and/or database management system. This will allow for easier presentation of the data in various formats, such as tables, contour figures, or graphs, and will also provide the information in a manner suitable for trend analysis. Consolidation of this data into spreadsheet format will also facilitate transfer of the data between various software applications. Hard copies of all information will be maintained for the duration, and after the completion, of the project.

9.0 FEASIBILITY STUDY APPROACH

9.1 PURPOSE

Potentially feasible technologies that may be applicable to Site constituents and conditions delineated during the RI will be evaluated concurrently with, and following the completion of, the RI activities. The results of this preliminary technology review will be combined into a Feasibility Study (FS) to evaluate potential remedial options to be implemented at the Site.

The purpose of the FS will be to synthesize and evaluate potential remedial alternatives for the areas of concern, if necessary. Technologies found to be applicable will be combined into multimedia alternatives to remediate the constituents of interest found at the Site. Information obtained during the treatability study phase of the RI, if necessary, will be utilized during the technology review and alternative evaluation phase of the FS.

9.2 SCOPE OF WORK

The scope of work for the preparation of the FS will include the following elements:

- Development of remedial action objectives and general response actions
- Preliminary screening of remedial technologies
- Development of remedial alternatives based on the technology screening
- Initial screening of remedial alternatives
- Detailed evaluation of remedial alternatives
- Preparation of draft and final FS reports

The proposed scope of work will be performed in accordance with the proposed schedule for the completion of the RI/FS detailed in Section 10.0.

9.3 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

Data generated during the RI will be evaluated to develop remedial action objectives for protecting human health and the environment. These objectives will be developed for the various media of concern, and will specify the following:

- Constituents of interest

- Potential exposure routes and receptors

- Concentration level or range of levels for each potential exposure pathway

After development of the remedial action objectives for the various media of concern at the Site, a listing of general response actions applicable for use in attaining the various objectives will be prepared. General response actions may include treatment, containment, excavation, extraction, disposal, institutional actions, in-situ treatment, innovative technologies, or other applicable response actions that have been used in similar situations or a combination of these options. General response actions will be medium specific, and will be refined during the course of the RI and FS.

Preparation of the preliminary remedial action objectives and the applicable general response actions will begin during the initial phases of the RI. Historical Site information will be used as the basis for these criteria and will be subject to modification depending on the results of the RI.

9.4 PRELIMINARY SCREENING OF REMEDIAL TECHNOLOGIES

After initial development of the medium-specific general response actions, remedial technologies, including No Action and innovative technologies that may be applicable for remediating the constituents of interest at the Site, will be reviewed. An inventory of potential technologies for remediation of soil, groundwater, and surface water, as required, will be initially prepared based on existing data from the Site. This listing will be reviewed based on:

- Existing Site conditions

- Physical and chemical characteristics of the constituents of interest

- Technology development

The technology listing will be expanded or reduced, depending on the preliminary results of the RI. Technology review will be performed concurrent with the RI field activities and will be finalized after all the RI data has been reviewed. Technologies found to be not applicable to existing Site conditions or constituents of interest will be eliminated from further consideration.

9.5 DEVELOPMENT OF REMEDIAL ALTERNATIVES BASED ON THE TECHNOLOGY SCREENING

After the completion of the preliminary technology screening, the remaining technologies will be combined to synthesize potentially feasible remedial alternatives based on the information collected during the RI. Basic considerations will include the affected environmental media, and the physical and chemical characteristics of the constituents of interest. The following items will be considered during the development of remedial alternatives:

- Existing and potential hazards to public health, welfare, and the environment; extent of impact; and the major pathways of migration

- Compliance with applicable, relevant, and appropriate EPA standards, guidance, or advisories as defined under EPA's CERCLA compliance policy

Based on the selected technologies remaining after the preliminary screening and the remedial objectives developed for the Site, alternatives will be developed for source control, source reduction, and/or offsite remedial actions. These alternatives will include:

- Source control measures that seek to treat, remove, stabilize, or contain the hazardous substances, if any, or to prevent or minimize migration of constituents from the source material

- Measures that manage constituents that have migrated from the original sources and pose a significant threat to public health or the environment. Particular consideration will be given to technologies that permanently contain, immobilize, destroy, detoxify, or recycle constituents.

The No Action alternative will also be considered during the development of the potentially feasible remedial alternatives and will be evaluated along with the other alternatives. Innovative technologies will also be evaluated to determine their applicability to existing Site and constituent conditions.

A matrix will be prepared identifying alternatives for the different environmental media that fall into one or more of the following categories:

- No Action

- Source control action alternatives, including alternatives that eliminate or minimize the need for long term management, utilize treatment as a primary component to address potential constituents of concern, or employ containment options that reduce public exposure and mobility of the constituents of concern but provide little or no treatment

- Groundwater response actions, if applicable, addressing relevant action levels to be achieved, and the projected timeframe to achieve the remedial goals

This matrix will summarize the components of each remedial alternative and will be used as a basis for the initial screening of remedial alternatives.

9.6 INITIAL SCREENING OF REMEDIAL ALTERNATIVES

Potentially applicable remedial alternatives will initially be evaluated relative to each other using baseline screening criteria relevant to each alternative. This screening will serve to eliminate those alternatives that do not achieve the selection criteria. The rationale for excluding selected alternatives from further considerations will be detailed under this section.

Each alternative will be evaluated for the short- and long-term aspects of effectiveness, implementability, and cost. The screening process will address the following criteria:

- <u>Effectiveness</u>
  - The potential effectiveness of the process options for handling the estimated areas or quantities of the affected media of concern and for achieving the remedial objectives in a timely manner
  - Potential environmental/public health impacts during and after construction
  - Degree of technology development, and effectiveness of technology for remediating Site constituents of interest
- <u>Implementability</u>
  - Feasibility and applicability of the alternative in view of existing Site conditions
  - Federal and State environmental permitting requirements
  - Local construction and implementation approval requirements
  - Availability of treatment, storage, and disposal services
  - Availability of necessary equipment and labor

- Cost

  - Capital cost of implementing alternative

  - Operations and maintenance costs

The results of the preliminary screening of alternatives will be summarized in tabular format at the completion of the initial review of alternatives.

9.7 DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

Remedial alternatives remaining after the preliminary screening will be developed in sufficient detail to allow for a comprehensive evaluation of each alternative for the following criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence of the alternative
- Reductions in toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

These criteria will provide the basis for comparison between the various remedial alternatives in achieving the desired remedial objective and will be discussed in the following sections.

9.7.1 Alternative Development

Each alternative will be detailed using the following considerations:

- Analysis of the alternative components and the specific logistical, equipment, and utility requirements (use of treatment technologies will be emphasized)

- Preparation of basic schematic diagrams for the various components of each alternative

- Definition of the operation and maintenance requirements associated with each alternative

- Definition of the implementation requirements for each alternative, including safety considerations, permitting and other regulatory requirements, temporary storage, offsite disposal, and transportation requirements

- Preparation of a conceptual Site plan for each alternative

- Development of a schedule for implementation

- Description of potential environmental impacts associated with the implementation of the alternative, include mitigation plans for any potential adverse impacts

9.7.2 Overall Protection of Human Health and the Environment

After detailed development, each alternative will be evaluated for the degree of mitigation of environmental and public health impacts afforded during and after implementation of the alternative. Separate Environmental and Public Health Assessments will be performed for each alternative during the detailed analysis.

9.7.2.1 Environmental Assessment

The Environmental Assessment (EA) for each alternative will focus on the Site problems and pathways of impact, if any, addressed by each alternative. The EA for each alternative will include, at a minimum, an evaluation of the beneficial and adverse effects of the response, and an analysis of measures that will be used to mitigate those effects. The No Action alternative will describe the current Site situation and will provide a forecast of anticipated environmental impacts in the event that remedial actions are not implemented. The No Action alternative will serve as the baseline for the EA.

9.7.2.2 Public Health Assessment

Each detailed alternative will be addressed in terms of the extent that it mitigates short- and long-term exposure effects to residual concentrations of the constituents of interest and protects the public health during and after the completion of the remedial action. The assessment will describe the levels and characteristics of the constituents of interest, if any, potential exposure routes, and potentially affected populations.

The No Action alternative will be described in terms of the short-term and the long-term impacts to public health. Each remedial alternative will be evaluated to determine the level of exposure to constituents of interest and the reduction of exposure over time. The reduction in public health impacts for each alternative will be compared to the No Action response.

9.7.3 Compliance with ARARs

Each alternative will be evaluated to determine compliance with the following ARARs:

- Chemical-specific ARARs, such as MCLs, to determine if compliance can be achieved under this alternative, or if a waiver is required

- Location-specific ARARs, such as wetland regulations, to determine if compliance can be achieved, or if a waiver is required

- Action-specific ARARs, such as RCRA minimum technology requirements, to determine if compliance can be achieved

ARARs potentially applicable to Site conditions, constituents, and proposed technologies will be summarized during the initial stages of the FS.

9.7.4 Technical Assessment

Technical assessment of the detailed alternatives will include evaluations of each alternative for long-term effectiveness and permanence; toxicity, mobility, and volume reduction; short-term effectiveness; and implementability of the alternative.

9.7.4.1 Long-term Effectiveness and Permanence

The various remedial alternatives will be evaluated to determine the relative risk that will remain at the Site after the completion of the remedial activity, and the extent and effectiveness of controls that may be required to manage that risk. Evaluation criteria under this category will include:

- The magnitude of the residual risk remaining on the Site after the completion of the alternative, including numerically based criteria, and the volume, toxicity, and/or mobility of the constituents of interest at the Site

- The adequacy and reliability of controls that will be utilized to manage the residual risk, and the effectiveness of these controls to reduce potential exposure to the residual materials onsite

9.7.4.2 Reduction of Toxicity, Mobility, or Volume through Treatment

The potential remedial alternatives will be evaluated to determine the extent of permanent reduction of the toxicity, mobility, or volume of the constituents at the Site using the following criteria:

- The treatment processes employed during remediation, and the materials amenable to treatment
- The quantity of the constituents of interest destroyed or treated, and how this will achieve the remedial objective(s)
- The degree of expected reductions in toxicity, mobility, or volume measured as a percentage of reduction
- The degree to which the treatment is irreversible
- The type and quantity of treatment residuals that will remain following treatment

Each alternative will also be evaluated as to the extent that the treatment process reduces the principal threat as defined in the remedial action objectives.

9.7.4.3 Short-Term Effectiveness

The short-term effectiveness of each alternative will be evaluated to determine potential impacts during implementation of the remedial action and the projected time frame to achieve the remedial goals. Evaluation criteria include:

- Protection of the public during the implementation of remedial activities
- Protection of Site employees during the remedial action
- Potential adverse environmental impacts that could result during the remedial action, and the effectiveness of available mitigation measures
- Projected timeframe to achieve the desired remedial objective(s)

9.7.4.4 Implementability

Implementability will address the technical, administrative, and service requirements necessary to successfully initiate a remedial alternative. Specific criteria include:

- A description of the special engineering requirements of the remedy and the Site preparation considerations

- Reliability of the proposed technology under operating conditions

- Ability to perform additional remedial actions in the event that subsequent activities are required to achieve the remedial objectives. This evaluation will include a description of how each alternative will be segmented into areas to allow implementation of the remedial alternative in separate phases.

- A description of operation, maintenance, and monitoring requirements of the remedy

- Ability to obtain approvals for implementing remedial action from other agencies

- An evaluation of the availability of appropriate treatment, storage, and disposal facilities

- Availability of necessary equipment, labor, material, and technology to implement the remedial action

9.7.5 Cost Assessment

The initial capital cost for the implementation of each remedial alternative, and the long-term operation and maintenance costs, will be evaluated. The costs will be presented as a present worth cost and will include both capital costs and annual operation and maintenance costs, including amortization and replacement costs for equipment, if necessary. A summary of costs over time will be provided for each alternative.

9.7.6 Community and State Acceptance

Each alternative will be evaluated relative to community and State acceptance. Issues and concerns that could be raised by the public during implementation of the alternative will be evaluated to determine the potential impact on selection of the alternative.

9.8 REPORT PREPARATION

A draft FS report will be prepared and submitted to EPA following completion of the evaluation of the remedial alternatives. The report will discuss the methodology and results of the following:

- Selection and evaluation of the preliminary remedial technologies
- Synthesis of remedial alternatives from applicable technologies
- Initial screening of alternatives
- Detailed screening of alternatives
- Comparative ranking of alternatives

After receipt of EPA's comments on the draft report, revisions will be made, and a final FS Report will be submitted to EPA.

10.0 PRELIMINARY SCHEDULE FOR RI AND FS ACTIVITIES

The preliminary schedules for the completion of the Phase I RI and the FS activities, including submission, review, and approval of documents, are presented in Figures 10-1 and 10-2. These schedules are subject to modification depending on conditions detected at the site, review and approval of required documents, and other situations not defined at this time.

The Phase I RI schedule incorporates one round of soil, sediment, and surface water sampling, monitoring well installation, and two rounds of groundwater sampling. Two rounds of Biological Resource Evaluation have also been included in the schedule and will be performed during late spring (May/June) and early fall (September/October). Data validation and draft report preparation have also been included under the Phase I RI schedule.

A timeframe for the performance of Treatability Studies, if required, has also been included under the Phase I RI schedule. The necessity for treatability studies will depend on the constituents of interest and the physical characteristics of the site. A separate Treatability Study Statement of Work and Work Plan will be prepared for EPA review and approval prior to implementing treatability studies, as noted on Figure 10-1.

Phase II RI activities, including the installation of additional monitoring wells, if required, have not been incorporated into this schedule. Phase II RI activities, if required, will be presented in a separate Phase II RI Work Plan, which will be submitted to EPA for review and approval prior to the initiation of field activities.

Preparation of the Feasibility Study will be performed after receipt of the final Risk Assessment from the EPA and completion of the treatability studies, if required. Preliminary review of technologies will be performed concurrently with RI activities, and will be completed after receipt of the final Risk Assessment from the EPA.

10.0 PRELIMINARY SCHEDULE FOR RI AND FS ACTIVITIES

The preliminary schedules for the completion of the Phase I RI and the FS activities, including submission, review, and approval of documents, are presented in Figures 10-1 and 10-2. These schedules are subject to modification depending on conditions detected at the site, review and approval of required documents, and other situations not defined at this time.

The Phase I RI schedule incorporates one round of soil, sediment, and surface water sampling, monitoring well installation, and two rounds of groundwater sampling. Two rounds of Biological Resource Evaluation have also been included in the schedule and will be performed during late spring (May/June) and early fall (September/October). Data validation and draft report preparation have also been included under the Phase I RI schedule.

A timeframe for the performance of Treatability Studies, if required, has also been included under the Phase I RI schedule. The necessity for treatability studies will depend on the constituents of interest and the physical characteristics of the site. A separate Treatability Study Statement of Work and Work Plan will be prepared for EPA review and approval prior to implementing treatability studies, as noted on Figure 10-1.

Phase II RI activities, including the installation of additional monitoring wells, if required, have not been incorporated into this schedule. Phase II RI activities, if required, will be presented in a separate Phase II RI Work Plan, which will be submitted to EPA for review and approval prior to the initiation of field activities.

Preparation of the Feasibility Study will be performed after receipt of the final Risk Assessment from the EPA and completion of the treatability studies, if required. Preliminary review of technologies will be performed concurrently with RI activities, and will be completed after receipt of the final Risk Assessment from the EPA.

ORIGINAL (Red)

11.0 REFERENCES CITED

Clement Associates, Inc., 1985. Chemical, physical, and biological properties present at hazardous waste sites, final report.

Environmental Research & Technology, Inc. and Koppers Company, Inc., 1984. Handbook on manufactured gas plant sites.

Federal Interagency Committee for Wetland Delineation, 1989. Federal manual for identifying and delineating jurisdictional wetlands. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture Soil Conservation Service, Washington, DC., Cooperative Technical Publication.

Green, Donald W., 1984. Perry's chemical engineers' handbook, sixth edition. McGraw-Hill Book Company, New York.

Johnston, R. H., 1973. Hydrology of the Columbia (Pleistocene) deposits of Delaware: an appraisal of a regional water-table aquifer. Delaware Geological Survey Bulletin Number 14.

Jordan, R. R., 1962. Stratigraphy of the sedimentary rocks of Delaware. Delaware Geological Survey Bulletin Number 9.

Jordan, R. R., 1968. Observations on the distribution of sand within the Potomac Formation of northern Delaware. Southeastern Geology, Volume 9, Number 2.

Jordan, R. R., 1972. Columbia (Pleistocene) sediments of Delaware. Delaware Geological Survey Bulletin Number 12.

Jordan, R. R., 1983, Stratigraphic nomenclature of nonmarine Cretaceous rocks on Inner margin of coastal plain in Delaware and adjacent states. Delaware Geological Survey Report of Investigations Number 37.

Lewis, Richard J., ed., 1991. Hazardous chemicals desk reference, second edition. Van Nostrand Reinhold, New York.

NUS Corporation, 1984. Site inspection of Koppers Company: prepared for the Hazardous Site Control Division, U.S. Environmental Protection Agency. Document reference R-585-11-5-37.

Petty, S., W. D. Miller, and B. A. Lanan, 1983. Potential for ground-water recharge in the coastal plain of northern New Castle County, Delaware. Delaware Geological Survey Open File Report Number 28, Sheet 1, Newark-Wilmington Area.

Plafkin, J. L., M. T. Barbour, K. D. Porter, and S. K. Gross, 1988. Rapid bioassessment protocols for use in streams and rivers: benthic macroinvertebrates and fish. Draft report RTI 82A from E. A. Engineering, Science and Technology, Inc. to the United States Environmental Protection Agency, Monitoring and Data Support Division.

Simpson, R. L., R. E. Good, M. A. Leck, and D. F. Whigham, 1983. The ecology of freshwater tidal wetlands. Bioscience, Volume 33, Number 4.

Soil Conservation Service, 1970. Soil survey of New Castle County, Delaware. U.S. Government Printing Office, Washington, D. C.

Spoljaric, N., 1967a. Pleistocene channels of New Castle County, Delaware. Delaware Geological Survey Report of Investigations Number 10.

Spoljaric, N., 1967b. Quantitative lithofacies analyses of Potomac Formation, Delaware. Delaware Geological Survey Report of Investigations Number 12.

Spoljaric, N., 1971. Origin of colors and ironstone beds in the Columbia Formation, Middletown-Odessa area, Delaware. Southeastern Geology, Volume 12, Number 4.

Spoljaric, N., 1972. Geology of the fall zone in Delaware. Delaware Geological Survey Report of Investigations Number 19.

Sundstrom, R. W., and T. E. Pickett, 1967. The availability of ground water from the Potomac Formation in the Chesapeake and Delaware Canal area, Delaware. University of Delaware Water Resources Center.

Sundstrom, R. W., and T. E. Pickett, 1971. The availability of ground water in New Castle County, Delaware. University of Delaware Water Resources Center.

U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, October 1988. Guidance for conducting remedial investigations and feasibility studies under CERCLA, interim final report. EPA 540 G-89 004.

U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, October 1986. Superfund Public Health Evaluation Manual. EPA/540/1-86/060.

U.S. Weather Bureau and National Oceanic and Atmospheric Administration (NOAA), 1978. Climates of the United States, Volumes 1 and 2. Detroit, Michigan, Gale Research Company.

Weast, Robert C., ed., 1982. CRC handbook of chemistry and physics, 62d Edition. CRC Press, Boca Raton, Florida.

Woodruff, K. D., 1977. Geohydrology of the Newark area, Delaware. Delaware Geological Survey Hydrologic Map Series Number 2, Sheet 1, Basic Geology.

Woodruff, K. D., 1978. Geohydrology of the Newark area, Delaware. Delaware Geological Survey Hydrologic Map Series Number 2, Sheet 2, Hydrologic Data.

Woodruff, K. D., 1981. Geohydrology of the Wilmington area, Delaware. Delaware Geological Survey Hydrologic Map Series Number 3, Sheet 1, Basic Geology.

Woodruff, K. D., 1984a. Geohydrology of the Wilmington area, Delaware. Delaware Geological Survey Hydrologic Map Series Number 3, Sheet 2, Hydrologic Data.

Woodruff, K. D., 1984b. Geohydrology of the Wilmington area, Delaware. Delaware Geological Survey Hydrologic Map Series Number 3, Sheet 3, Structural Geology, Elevation of the base of sand in the upper part of the Potomac Formation.

Woodruff, K. D., 1985. Geohydrology of the Wilmington area, Delaware. Delaware Geological Survey Hydrologic Map Series Number 3, Sheet 4, Structural Geology, Elevation of top and isopach map of the upper sandy zone, Potomac Formation.

Woodruff, K. D., 1986. Geohydrology of the Chesapeake and Delaware Canal area. Delaware Geological Survey Hydrologic Map Series Number 6, Sheet 1, Basic Geology.

Woodruff, K. D., and A. M. Thompson, 1972. Geology of the Newark area, Delaware. Delaware Geologic Survey Map Series Number 3.

Woodruff, K. D., and A. M. Thompson, 1975. Geology of the Wilmington area, Delaware. Delaware Geologic Survey Map Series Number 4.

Woodward-Clyde Consultants, 1987. Hydrogeology report, DuPont-Newport site, Newport, Delaware.

Table 2-1
Summary of Semivolatile Results
Koppers Company, Inc. Newport Site
Newport, Delaware

Sample ID	Sample Location and Description	Phase	Units	PARAMETER									
				Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Chrysene	Fluoranthene	Fluorene	Phenanthrene	Pyrene
C7253	Midstream White Clay	solid	ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7254	East Drainage	solid	ug/kg	ND	3,230	4,190	2,410	2,730	3,350	6,620	ND	4,920	4,130
C7255	Drainage from Old Foundation	solid	ug/kg	ND	11,400	26,900	36,000	ND	19,600	28,100	ND	ND	15,400J
C7315	Material in Field	solid	ug/kg	ND	2,660	6,750	9,720	7,860	6,900	6,300	ND	ND	5,560
C7316	Upstream White Clay	solid	ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7317	Old Fire Pond	solid	ug/kg	25,200	41,800	63,100	90,700	ND	54,900	75,900	ND	11,100J	76,300
C7341	Upstream Hershey Run	aqueous	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7342	Midstream Hershey Run	aqueous	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7343	Midstream White Clay	aqueous	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7344	East Drainage	aqueous	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7345	Drainage from Old Foundation	aqueous	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7346	Drainage 1A	aqueous	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7347	Upstream White Clay	aqueous	ug/l	ND	ND	- ND	ND	ND	ND	ND	ND	ND	ND
C7348	Old Fire Pond	aqueous	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7350	Upstream Hershey Run	solid	ug/kg	1,870	3,890	10,600	8,480	6,060	6,260	1,870	ND	1,080	1,380
C7351	Midstream Hershey Run	solid	ug/kg	7,430	2,060	2,860	2,230	2,320	2,990	1,240	896	2,510	1,750

ND – Compound not detected in sample above Method Detection Limits

Source: NUS Report "Site Inspection of Koppers Company", December 1984, R-585-11-37

Table 2-2
Summary of HSL Metals Results
Koppers Company, Inc. Newport Site
Newport, Delaware

Sample ID	Sample Location and Description	Phase	Units	PARAMETER			
				Aluminum	Barium	Lead	Magnesium
MC 4586	Upstream Hershey Run	solid	mg/kg	20,000	896	462	5,380
MC 4588	Midstream White Clay	solid	mg/kg	23,400	239	84	6,160
MC 4587	Midstream Hershey Run	solid	mg/kg	14,800	161	14	4,890
MC 4589	East Drainage	solid	mg/kg	3,280	103	659	4,200
MC 4788	Drainage from Old Foundation	solid	mg/kg	19,300	412	30	10,600
MC 4789	Material in Field	solid	mg/kg	1,100	336	25	27,400
MC 4790	Upstream White Clay	solid	mg/kg	14,600	135	33	4,500
MC 4791	Old Fire Pond	solid	mg/kg	1,920	199	248	1,690
MCA 227	Upstream Hershey Run	aqueous	ug/l	1,510	111	ND	9,120
MCA 228	Midstream Hershey Run	aqueous	ug/l	3,420	69	5.7	10,200
MCA 229	Midstream White Clay	aqueous	ug/l	2,940	101	ND	10,900
MCA 230	East Drainage	aqueous	ug/l	412	98	ND	7,850
MCA 231	Drainage from Old Foundation	aqueous	ug/l	23,120	103	17	47,300
MCA 232	Drainage 1A	aqueous	ug/l	456	80	5.2	7,620
MCA 233	Upstream White Clay	aqueous	ug/l	280	52	ND	8,850
MCA 234	Old Fire Pond	aqueous	ug/l	728	163	ND	29,600

ND – Compound not detected in sample above Method Detection Limits

Source: NUS Report "Site Inspection of Koppers Company", December 1984, R-585-11-37

Table 2-3
Climatological Conditions For Wilmington, Delaware
Koppers Company, Inc. Newport Site
Newport, Delaware

Month	Temperature		Precipitation		
	Average Daily Maximum (°F)	Average Daily Minimum (°F)	Average Total (in)	One Year in 10 will have: Less than: (in)	One Year in 10 will have: More Than: (in)
January	41.3	25.5	3.40	1.7	6.0
February	42.4	25.2	2.95	1.8	4.2
March	50.5	32.0	4.02	2.1	6.0
April	62.5	41.6	3.33	1.8	6.2
May	73.4	52.0	3.53	1.3	7.1
June	81.8	61.0	4.07	1.4	6.3
July	86.2	65.8	4.25	1.3	7.5
August	84.2	64.3	5.59	2.3	10.7
September	77.9	57.3	3.95	0.9	7.1
October	67.3	45.9	2.91	1.6	5.7
November	55.1	35.7	3.53	1.0	7.1
December	43.5	26.7	3.03	1.4	5.3
Year	63.8	44.4	44.56	33.7	51.5

Source: Soil Conservation Service, 1970, Soil Survey of New Castle County, Delaware, Washington, D.C., U.S. Government Printing Service

Table 6-1
Summary of Data Quality Objectives and Data Gathering Requirements
Koppers Company, Inc. Newport Site
Newport, Delaware

1. REMEDIAL ACTION OBJECTIVE		MEDIA
Control human exposure to airborne material		Air
PROGRAM OBJECTIVES		**CONSTITUENTS OF INTEREST**
o Characterize air quality o Identify areas of concern o Evaluate areas of concern		Particulates Volatile Organic Compounds metals
TYPE OF INVESTIGATION		**PRIORITIZED DATA USES**
o Ambient Air Quality o Background Air Quality		o Site Screening o Health & Safety Monitoring o Risk Assessment
DATA GATHERING PROGRAM	**APPROPRIATE ANALYTICAL LEVEL**	**PLANNED ANALYSES**
o Analyzes meteorological conditions	N/A	N/A
o Conduct upwind and site survey using photoionization detector	1	Refer to Section 7.0
o Evaluate area(s) of concern using portable GC	2	N/A
o Monitor during drilling periods	1	Refer to Section 7.0
o Conduct upwind and downwind air monitoring program	1	N/A

Table 6-1
Summary of Data Quality Objectives and Data Gathering Requirements
Koppers Company, Inc. Newport Site
Newport, Delaware

2. REMEDIAL ACTION OBJECTIVE		MEDIA
Control human dermal exposure to constituents of concern		Surface soils
PROGRAM OBJECTIVES		**CONSTITUENTS OF INTEREST**
o Verify site security o Locate potential source areas o Characterize extent of surficial material o Evaluate direct contact exposures o Evaluate remedial alternatives		PAHs Phenolics Pesticides VOCs metals
TYPE OF INVESTIGATION		**PRIORITIZED DATA USES**
o Surface soil samples o Sediment samples o Surface water samples		o Site Screening o Health & Safety Monitoring o Risk Assessment o Remedial alternative development
DATA GATHERING PROGRAM	**APPROPRIATE ANALYTICAL LEVEL**	**PLANNED ANALYSES**
o Conduct security survey of site	N/A	N/A
o Collect surface soil samples from areas of concern	3,4	Refer to Section 7.0
o Collect sediment samples from areas of concern	3,4	Refer to Section 7.0
o Collect surface soil samples from background areas	3,4	Refer to Section 7.0

Table 6-1
Summary of Data Quality Objectives and Data Gathering Requirements
Koppers Company, Inc. Newport Site
Newport, Delaware

3. REMEDIAL ACTION OBJECTIVE		MEDIA
Control human exposure to constituents of concern in surface water, and sediments in wetlands and surface water bodies		Wetland surface water and sediments
PROGRAM OBJECTIVES		**CONSTITUENTS OF INTEREST**
o Assess background conditions o Identify potential constituents of concern o Characterize extent of constituents o Evaluate potential constituent migration and impact o Evaluate remedial alternatives		PAHs Phenolics Pesticides VOCs Metals
TYPE OF INVESTIGATION		**PRIORITIZED DATA USES**
o Literature Search o Field Reconnaissance o Surface water/Sediment sampling and analysis		o Site Screening o Health & Safety Monitoring o Site Characterization o Risk Assessment o Remedial alternative development
DATA GATHERING PROGRAM	**APPROPRIATE ANALYTICAL LEVEL**	**PLANNED ANALYSES**
o Conduct Literature search	N/A	Refer to Section 7.0
o Conduct field reconnaissance after storm events	N/A	Refer to Section 7.0
o Identify data gaps	N/A	Refer to Section 7.0
o Collect surface water samples from historical ponds, drainage areas and wetlands	3,4	Refer to Section 7.0
o Collect sediment samples from historical ponds, drainage areas and wetlands	3,4	Refer to Section 7.0

Table 6–1
Summary of Data Quality Objectives and Data Gathering Requirements
Koppers Company, Inc. Newport Site
Newport, Delaware

4. REMEDIAL ACTION OBJECTIVE		MEDIA
Control potential constituent migration from subsurface sources		Subsurface source materials and soils
PROGRAM OBJECTIVES		**CONSTITUENTS OF INTEREST**
o Evaluate buried source material/soils o Locate subsurface utilities		PAHs Phenolics Pesticides VOCs Metals
TYPE OF INVESTIGATION		**PRIORITIZED DATA USES**
o Geophysical logging of boreholes o Soil sample collection in selected areas of concern		o Site Characterization o Remedial Alternatives
DATA GATHERING PROGRAM	**APPROPRIATE ANALYTICAL LEVEL**	**PLANNED ANALYSES**
o Collect soil samples in selected areas of the site	3,4	Refer to Section 7.0
o Conduct geophysical logging of boreholes	2	Refer to Section 7.0

Table 6-1
Summary of Data Quality Objectives and Data Gathering Requirements
Koppers Company, Inc. Newport Site
Newport, Delaware

5. REMEDIAL ACTION OBJECTIVE	MEDIA
Control the potential for constituent migration from soil to groundwater	Soil, unconsolidated deposits

PROGRAM OBJECTIVES	CONSTITUENTS OF INTEREST
o Assess background conditions o Evaluate source areas o Evaluate subsurface geology o Identify constituents of concern o Characterize nature and extent of soils impact	PAHs Phenolics Pesticides VOCs Metals

TYPE OF INVESTIGATION	PRIORITIZED DATA USES
o Soil borings o Formation sampling o Field Screening o Shelby tube sampling o Geotechnical analysis	o Site Characterization o Risk Assessment o Site-specific parameters

DATA GATHERING PROGRAM	APPROPRIATE ANALYTICAL LEVEL	PLANNED ANALYSES
o Conduct literature search	N/A	Refer to Section 7.0
o Conduct background soil sampling	3,4	Refer to Section 7.0
o Collect split-spoon samples during well installation program	5	Refer to Section 7.0
o Collect Shelby tube samples of aquitard clay during well installation	5	Refer to Section 7.0

Table 6-1
Summary of Data Quality Objectives and Data Gathering Requirements
Koppers Company, Inc. Newport Site
Newport, Delaware

6. REMEDIAL ACTION OBJECTIVE		MEDIA
Control human exposure to constituents in site groundwater		Groundwater
PROGRAM OBJECTIVES		**CONSTITUENTS OF INTEREST**
o Evaluate subsurface geology/hydrogeology o Identify constituents of concern o Evaluate groundwater quality o Assess exposure to groundwater o Evaluate groundwater remedial alternatives		PAHs Phenolics Pesticides VOCs Metals
TYPE OF INVESTIGATION		**PRIORITIZED DATA USES**
o Installation and sampling of monitoring wells o Water level measurements o Aquifer testing		o Site Characterization o Risk Assessment o Remedial Alternatives
DATA GATHERING PROGRAM	**APPROPRIATE ANALYTICAL LEVEL**	**PLANNED ANALYSES**
o Install 11 – 22 monitoring wells	N/A	Refer to Section 7.0
o Collect 2 rounds of water samples from new monitoring wells	3,4	Refer to Section 7.0
o Evaluate available data to determine the necessity for a Phase II investigation	N/A	Refer to Section 7.0

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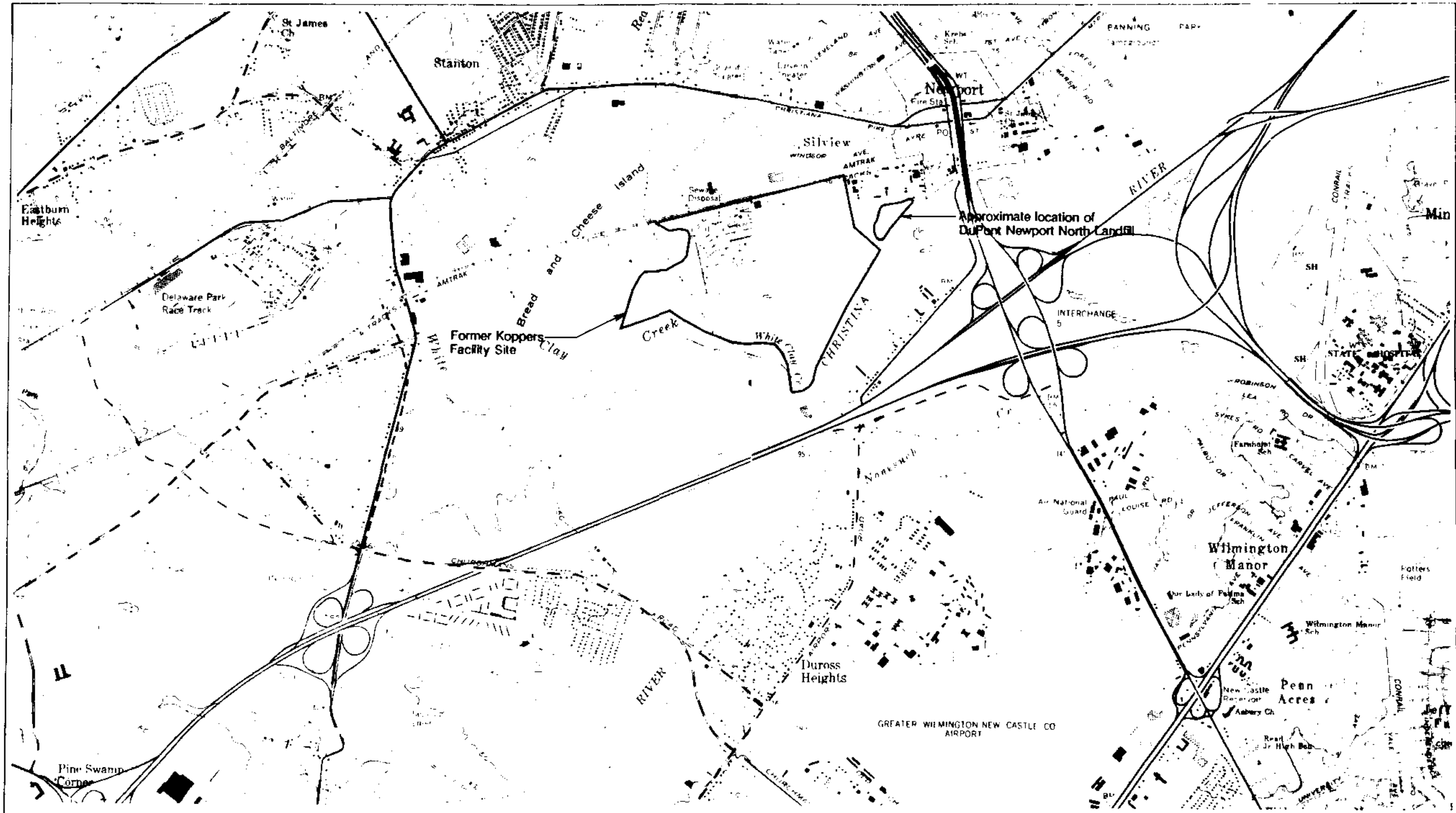


SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC MAPS: NEWARK EAST, DELAWARE, 1953, PHOTOREVISED 1985; WILMINGTON SOUTH, DELAWARE - NEW JERSEY, 1967, PHOTOREVISED 1987.

N

0 2000 4000
Scale in Feet

Figure 2-1
Site Location Map
Former Koppers Facility
Newport, Delaware
Dames & Moore

AR300092

LEGEND

Am Aldino-Keyport-Mattapex-Urban land complex

Ou Othello-Fallsington-Urban land complex

Tm Tidal marsh

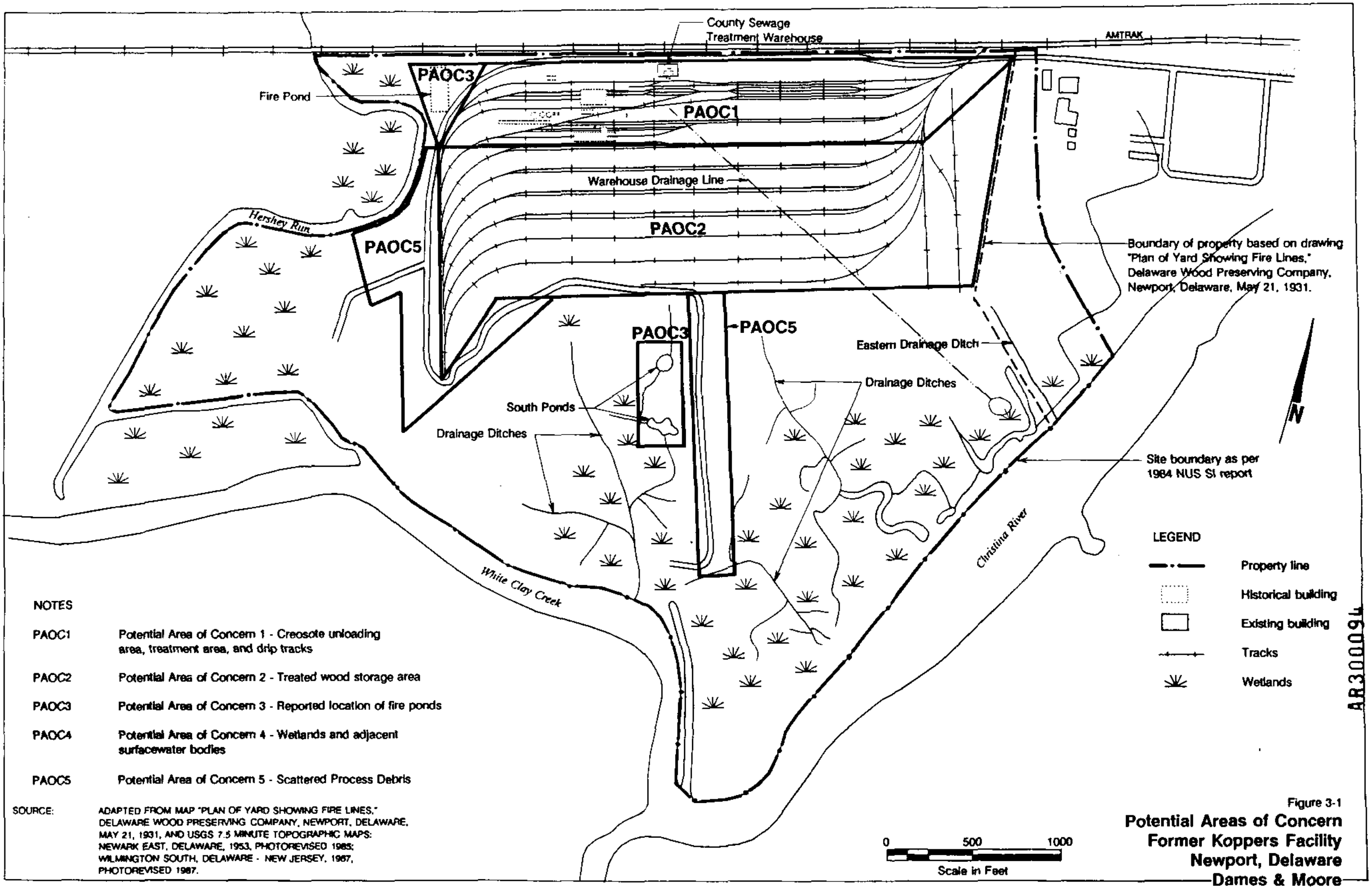
Source: Soil Survey, New Castle County, Delaware, US Department of Agriculture, Soil Conservation Service, October 1970

N

0 1/4 1/2
Scale in Miles

Figure 2-2
Soils Classification Map
Former Koppers Facility
Newport, Delaware

Dames & Moore



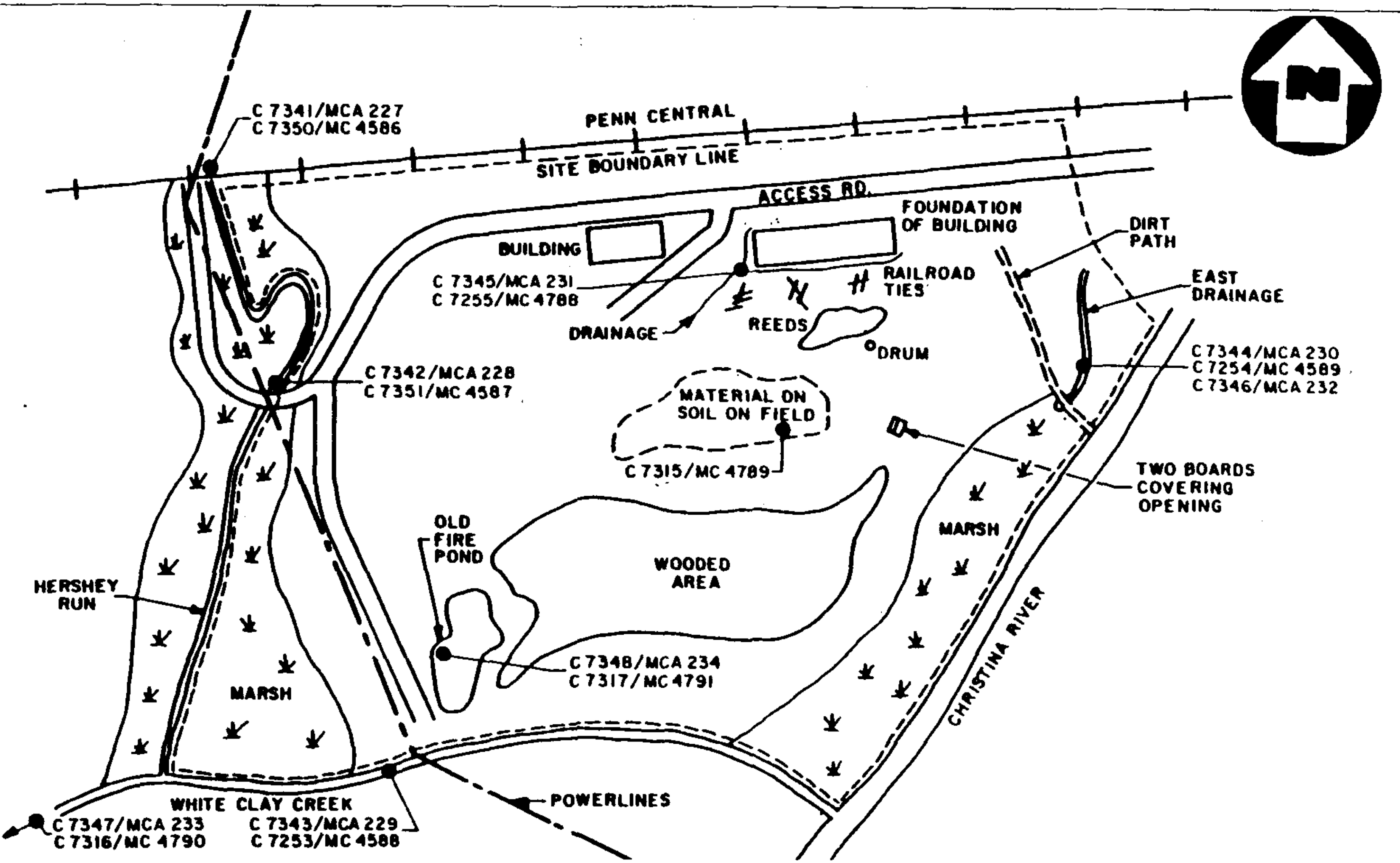
NOTES

PAOC1	Potential Area of Concern 1 - Creosote unloading area, treatment area, and drip tracks
PAOC2	Potential Area of Concern 2 - Treated wood storage area
PAOC3	Potential Area of Concern 3 - Reported location of fire ponds
PAOC4	Potential Area of Concern 4 - Wetlands and adjacent surfacewater bodies
PAOC5	Potential Area of Concern 5 - Scattered Process Debris

SOURCE: ADAPTED FROM MAP "PLAN OF YARD SHOWING FIRE LINES," DELAWARE WOOD PRESERVING COMPANY, NEWPORT, DELAWARE, MAY 21, 1931, AND USGS 7.5 MINUTE TOPOGRAPHIC MAPS: NEWARK EAST, DELAWARE, 1953, PHOTOREVISED 1985; WILMINGTON SOUTH, DELAWARE - NEW JERSEY, 1967, PHOTOREVISED 1987.

Figure 3-1

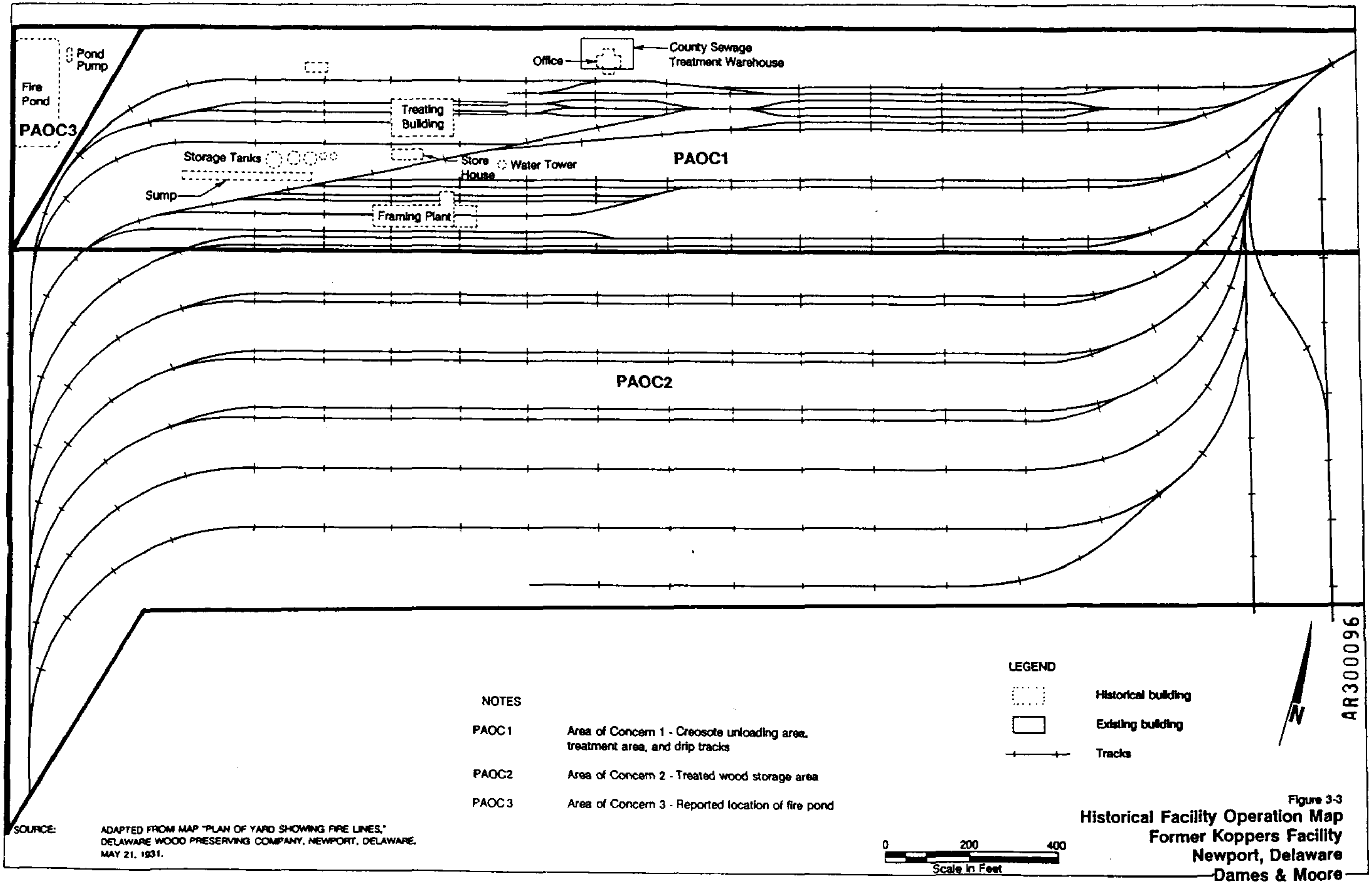
Potential Areas of Concern
Former Koppers Facility
Newport, Delaware
Dames & Moore



Source: "Site Inspection of Koppers Company,
Prepared Under TDD No. F3-8411-14,
EPA No. DE-19, Contract No. 68-01-6699,"
Prepared by NUS Corporation, February 27, 1986.

Not to Scale

Figure 3-2
NUS Sample Location Map
Former Koppers Facility
Newport, Delaware
Dames & Moore



NOTES

PAOC1	Area of Concern 1 - Creosote unloading area, treatment area, and drip tracks
PAOC2	Area of Concern 2 - Treated wood storage area
PAOC3	Area of Concern 3 - Reported location of fire pond

SOURCE: ADAPTED FROM MAP "PLAN OF YARD SHOWING FIRE LINES," DELAWARE WOOD PRESERVING COMPANY, NEWPORT, DELAWARE. MAY 21, 1931.

Figure 3-3
Historical Facility Operation Map
Former Koppers Facility
Newport, Delaware
Dames & Moore

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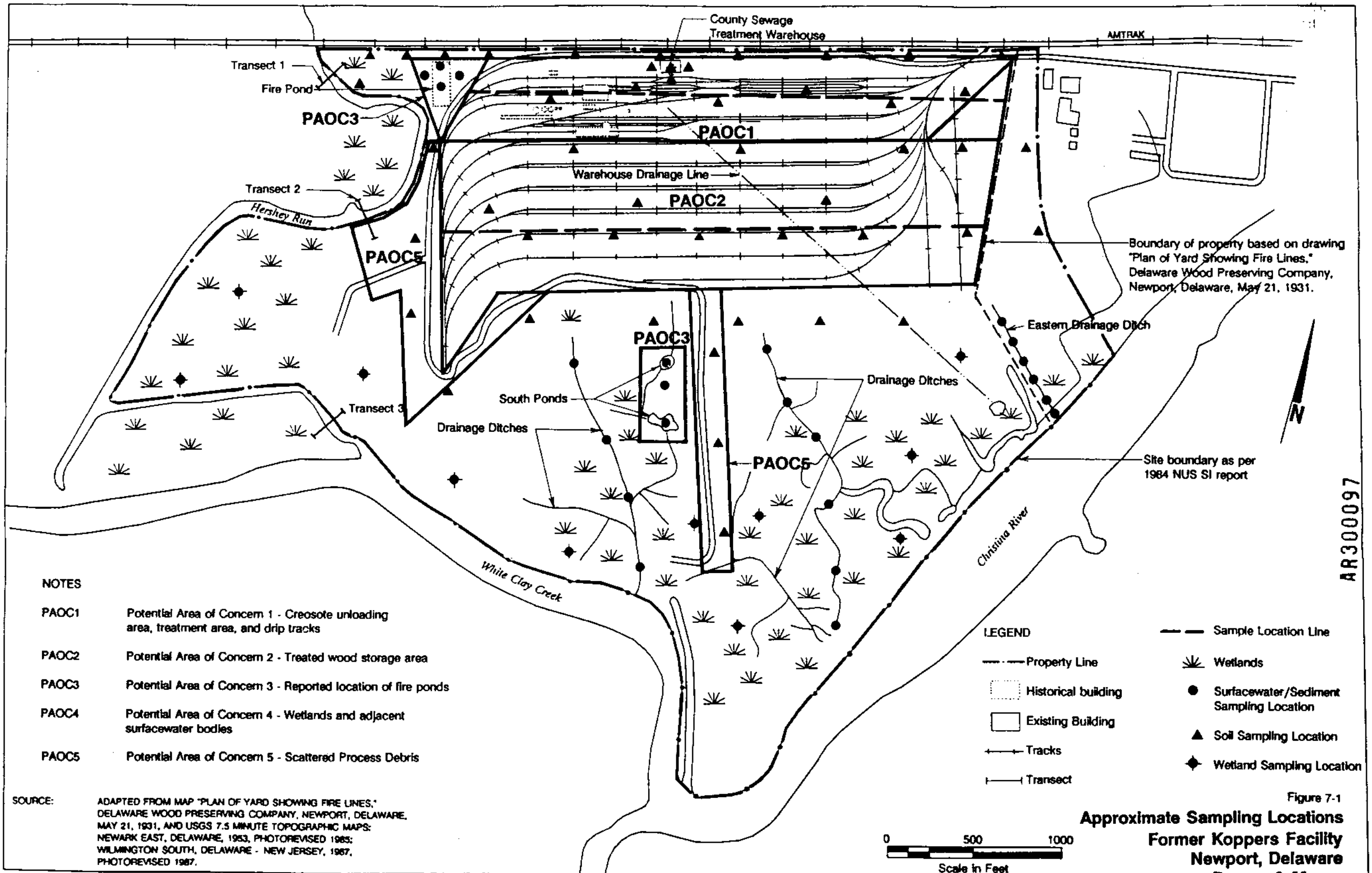


NOTES

PAOC1 Potential Area of Concern 1 - Creosote unloading area, treatment area, and drip tracks

PAOC2 Potential Area of Concern 2 - Treated wood storage area

PAOC3 Potential Area of Concern 3 - Reported location of fire ponds

PAOC4 Potential Area of Concern 4 - Wetlands and adjacent surfacewater bodies

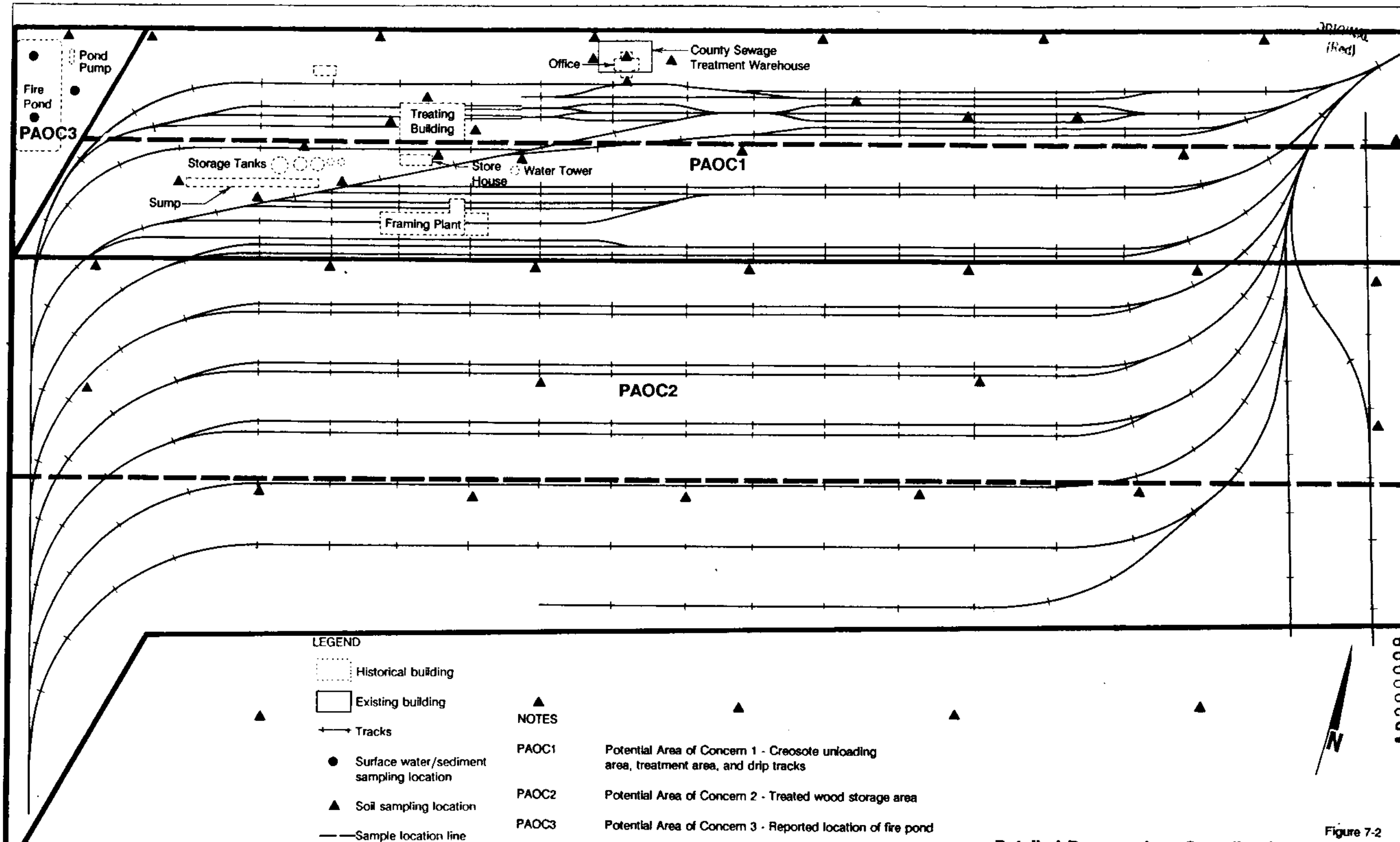
PAOC5 Potential Area of Concern 5 - Scattered Process Debris

SOURCE: ADAPTED FROM MAP "PLAN OF YARD SHOWING FIRE LINES," DELAWARE WOOD PRESERVING COMPANY, NEWPORT, DELAWARE, MAY 21, 1931, AND USGS 7.5 MINUTE TOPOGRAPHIC MAPS: NEWARK EAST, DELAWARE, 1953, PHOTOREVISED 1985; WILMINGTON SOUTH, DELAWARE - NEW JERSEY, 1967, PHOTOREVISED 1987.

Figure 7-1

Approximate Sampling Locations
Former Koppers Facility
Newport, Delaware

Dames & Moore



SOURCE ADAPTED FROM MAP "PLAN OF YARD SHOWING FIRE LINES," DELAWARE WOOD PRESERVING COMPANY, NEWPORT, DELAWARE, MAY 21, 1931.

Figure 7-2

Detailed Process Area Sampling Location Map
Former Koppers Facility
Newport, Delaware
Dames & Moore

AR300098

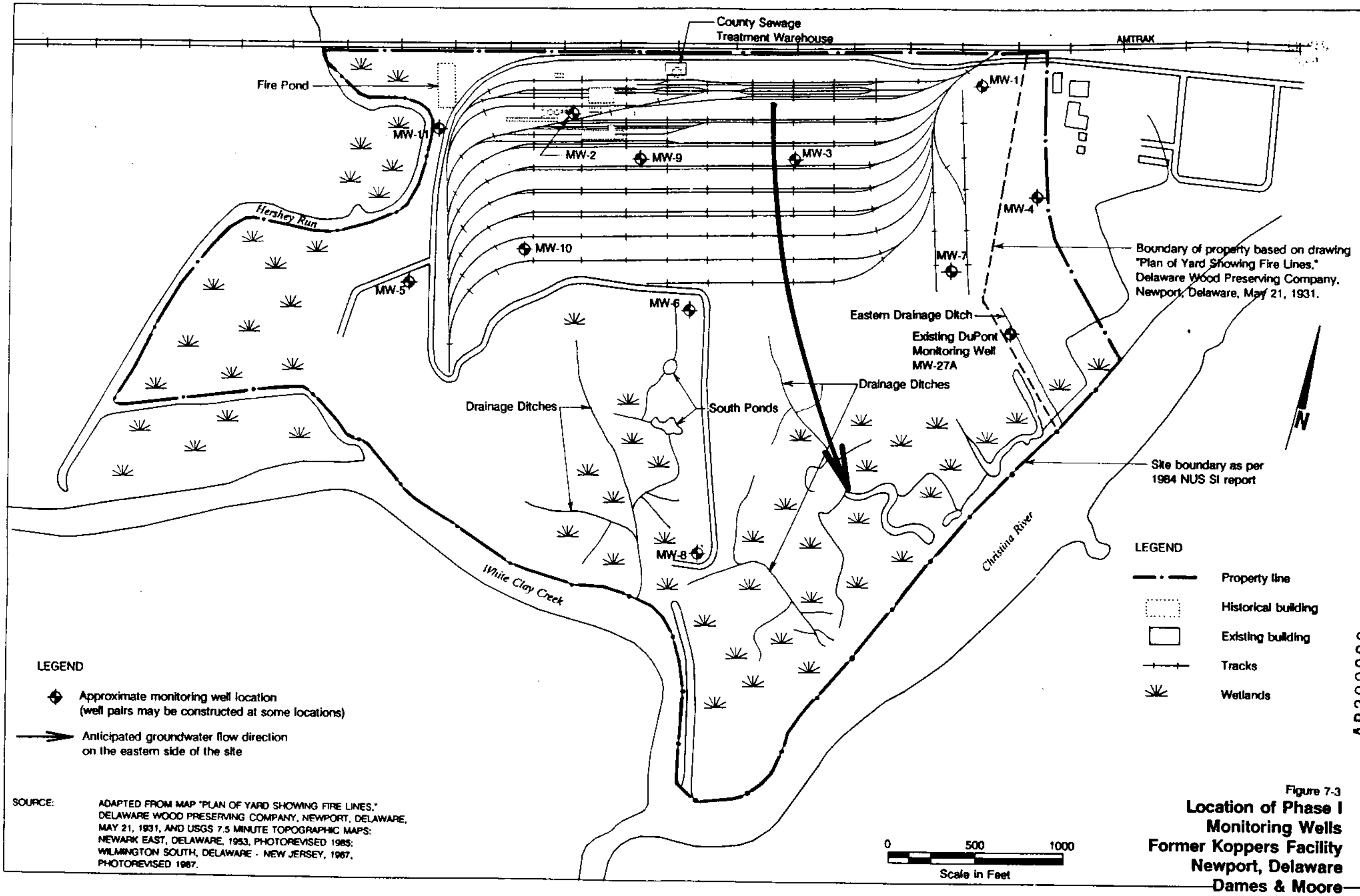


Figure 7-3
Location of Phase I Monitoring Wells
Former Koppers Facility
Newport, Delaware
Dames & Moore

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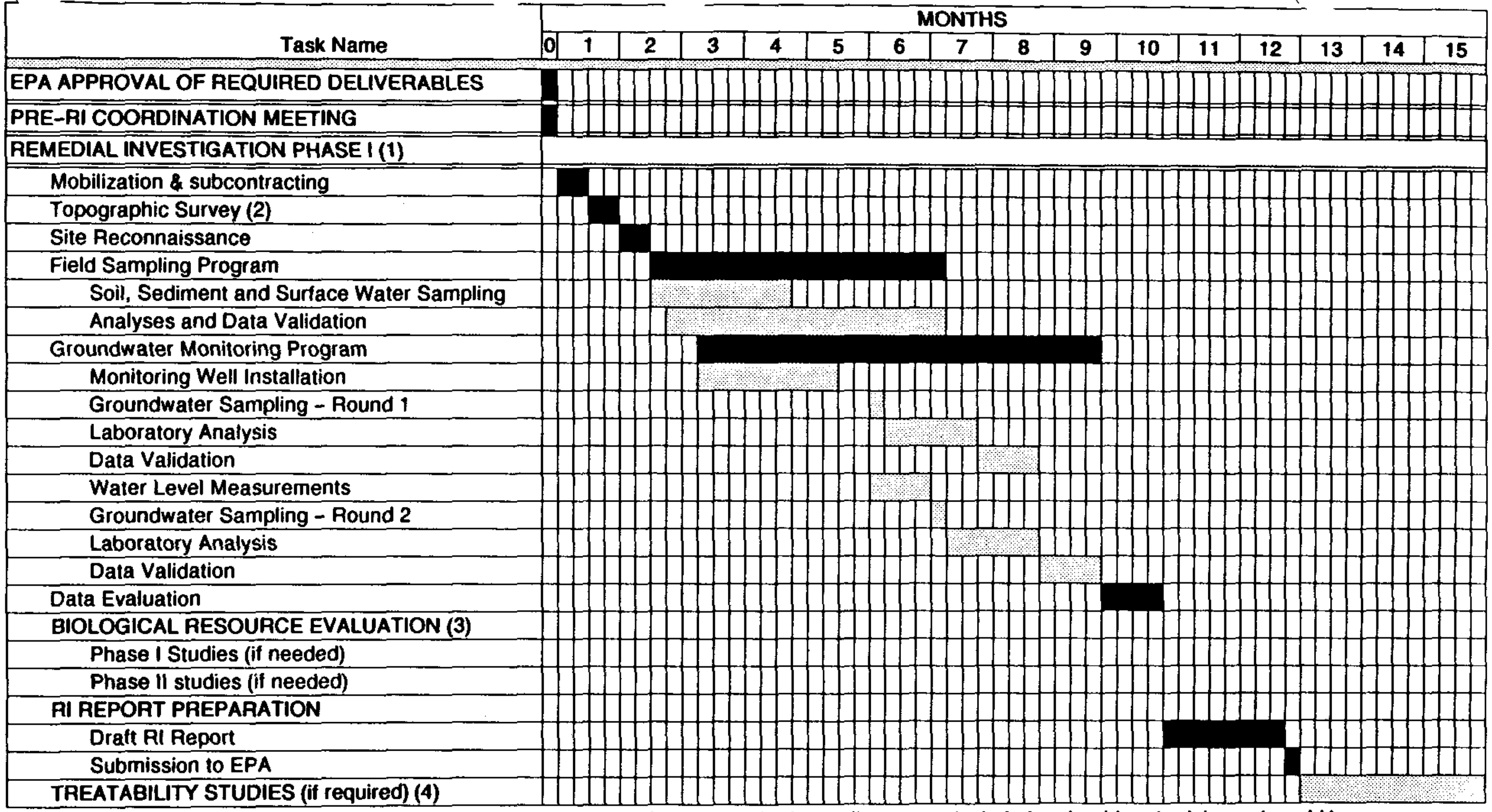


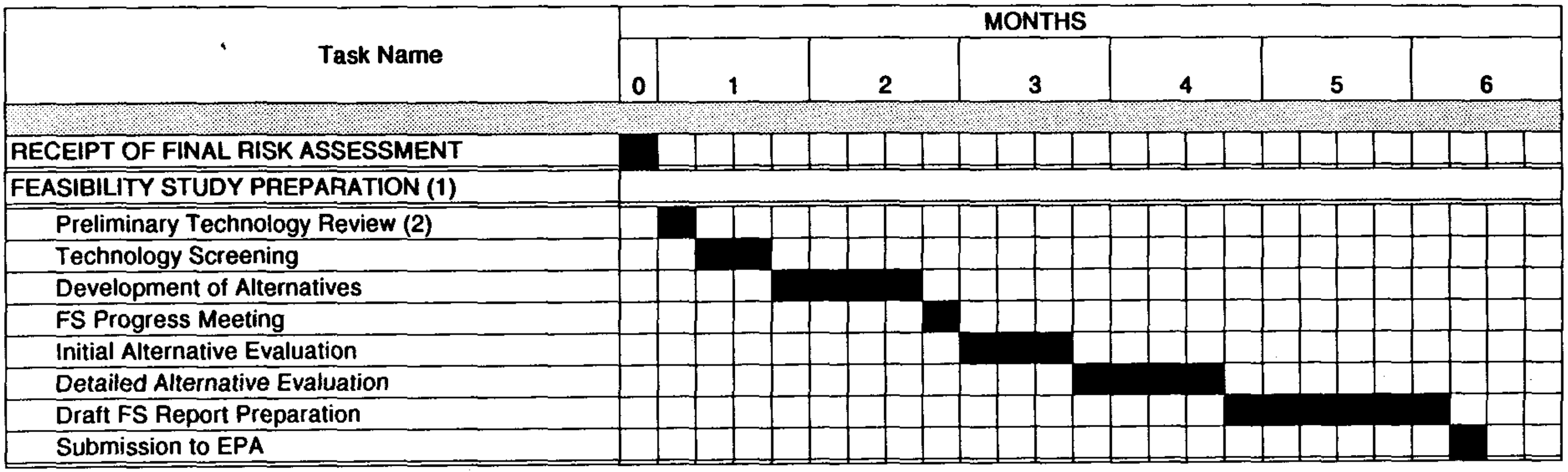
(1) Phase II RI activities, if necessary, including the installation of Phase II monitoring wells, are not included under this schedule, and would be addressed under a separate Phase II RI Work Plan and schedule.

(2) Performance of the Aerial Topographic Survey and preparation of the base map may be conducted prior to initiation of Site activities during late fall/early spring to take advantage of the lack of vegetation during these times of the year.

(3) Biological Resource Evaluation, if required, would be performed twice during the year, during May/June and during September/October, in order to appropriately evaluate and characterize existing conditions.

(4) The time frame for performance of the Treatability Studies is presented for illustration only. Performance of the Treatability Studies, if required, will not commence until EPA approval of the Treatability Testing Statement of Work and the Treatability Testing Work Plan.

Figure 10-1
Phase I Remedial Investigation Schedule
Koppers Company, Inc. Newport Site
Dames & Moore



(1) Feasibility Study preparation will commence after receipt of the Final Risk Assessment to be prepared by the EPA.

(2) Preliminary Review of Technologies will be performed during the course of the RI, and will be completed after receipt of the Final Risk Assessment from the EPA.

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Figure 10-2
Feasibility Study Schedule
Koppers Company, Inc. Newport Site
Dames (ore

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APPENDIX A

MONITORING WELL INSTALLATION AND SAMPLING PROTOCOLS

1.0 MONITORING WELL INSTALLATION PROCEDURES

Boreholes for the wells will be drilled using hollow-stem augers equipment or other appropriate drilling methods suitable for the conditions encountered. Selected soil borings drilled as part of the soils investigation may be advanced below the water table to be converted into monitoring wells. All proposed well locations will be investigated for subsurface utilities before drilling activities begin. Precautions will be taken to ensure easy access for the drilling rig because the land may be somewhat swampy. If necessary, specialized drilling equipment designed for use in swampy terrain may be used to install the wells.

Specific details for geologic logging, well installation and well design will be provided in the FSP; however, some of the general details include:

1. Geological Logging. Split spoon samples will be collected, described according to Unified Soil Classification (USC) methods, and logged at 2 foot intervals within the first 10 feet and at 5 foot intervals thereafter. The drilling will be advanced until the Potomac Formation is encountered. To minimize the depth of penetration into the Potomac, a confirmatory split-spoon sample will be obtained as soon as there is an indication that a change in lithology has occurred. A Shelby tube sample will be attempted if low permeability (clayey) Potomac Formation sediments are found directly beneath permeable sandy zones of the Columbia Formation. If sufficient sample volume is recovered, the Shelby tube sample will be submitted to a geotechnical laboratory for analysis of hydraulic conductivity. A soil sample will be selected from the anticipated screened interval from the retained split spoon samples and submitted for geotechnical analysis (e.g., grain size analysis, Atterberg limits). Geophysical logs (natural gamma, spontaneous potential, and resistivity) may be obtained from selected wells to facilitate the identification of subsurface stratigraphy.

2. Well design and construction. The installation of the monitoring wells will follow the construction guidelines described in the Delaware Department of Natural Resources and Environmental Control's "Delaware Regulations Governing the Construction of Water Wells." If a permeable sandy zone in the Potomac Formation is encountered during the drilling of the Phase I borings, then, as a precaution, at least 2 feet of bentonite will be placed in the bottom of the boring before construction of the well in order to minimize any direct connection between the Potomac and the Columbia created by the borehole. Each well will be constructed of 4-inch diameter, flush-jointed PVC casing with a variable length (not to exceed 15 feet below the water table) of 4-inch diameter 0.020-slot PVC screen.

3. Well development. The potential well development method is pumping and surging. The wells most likely will be pumped and surged with a goal of

obtaining low turbidity discharge water with stabilized geochemical characteristics (conductivity, pH, and temperature). Air lift development methods may be used if pumping and surging do not achieve these development goals.

4. Well elevation and location survey. The horizontal locations and vertical measuring point elevations (relative to NGVD) of each newly installed monitoring wells will be established by a Delaware licensed surveyor.

5. Disposition of well drill cuttings and development water. Drill cuttings will be drummed in labeled drums and stored in a designated area on pallets until soil and/or water quality data are received. Development water and purge water from sampling activities will drummed or stored in an above ground tank. Drill cuttings, development water and purge water will be stored, handled and ultimately disposed of in accordance with applicable laws and regulations.

2.0 GROUNDWATER SAMPLING AND WATER LEVEL MEASUREMENTS

Groundwater sampling will begin no sooner than 1 week after a well has been developed. The wells will be purged of a volume of water equivalent to at least three well volumes using appropriate equipment. Subsequent to purging, samples will be collected and analyzed for parameters specified in Section 6.0. Specific groundwater sampling procedures will be presented in the FSP.

There will be two rounds of groundwater sampling to characterize the groundwater quality. The first round of sampling will test for the full list of parameters described in Section 6.0, while the second round samples will be analyzed for those parameters detected in the first round in order to provide confirmation of their detection.

At least two rounds of water level measurements in all wells at the Site will be performed during Phase I. The hydrogeologic study at the nearby Dupont Landfill indicated no tidal influence on the water levels in the Columbia aquifer; however, the potential effects of tidal fluctuation on the Columbia aquifer at the Site will be evaluated by recording the water level fluctuations over a period of time in various Columbia aquifer monitoring wells at the Site. Methods that can be used to measure water level fluctuations in the monitoring wells include:

- Discrete water level measurements, using appropriate manual water level measurement devices

- Continuous water level measurements using Stevens water level recorders or electronic recording of pressure transducers

The choice of monitoring method employed will be made after the Site security arrangements have been evaluated.

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